The Vedic Tradition

Cosmos, Connections, and Consciousness

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Foreword

The idea of this collection of essays was suggested to me recently by Chanceller H.R. Nagendra of Swami Vivekananda Yoga Anusandhana Samsthana in Bengaluru that is popularly known as S-VYASA University. The collection consists mostly of published papers that have appeared in various journals, not all of which may be readily accessible to the researcher or the interested layperson.

The essays have been divided into six parts to cover different aspects of this tradition that presents its enduring influence not only on the intellectual and lived life in India, but also on the rest of the world. These are: (i) Overview; (ii) Large Connections; (iii) Sanskrit and the World; (iv) Inner and Outer Cosmoses; (v) Reality and Art; and (vi) Science and Consciousness. Apart from essays on the earliest layers of the Vedic tradition, there is material on its pervading influence on modern science. Many will be intrigued by how quantum theory, the deepest theory of physics that we know, is seen by scholars to be consistent with Vedanta, and may like to explore primary sources for themselves. Each chapter comes with its own references.

The first part begins with essays on how to read the Vedas and the discovery of its insights through different disciplines of Yoga, along with the translation of seven hymns from the Ṛgveda. The other essays describe the Goddess in the Ṛgveda and in neighboring civilizations, many-faced Viṣṇu and Śiva images, the Śiva Sūtras, how the Buddha on his deathbed accepted the notion of the atman, and how the six darśanas may be increased to nine.

The second part has two chapters on archaeoastronomy of Indian temples and monuments, the practice of shamanism, and Vedic ideas beyond the Himalayas in Central Asia, the Slavic world, and in Indonesia.

The third part has essays on the Indo-European language family and how it was misused by European scholars to futher nineteenth-century colonial ends. It also has a chapter on the notion of India within the Indian tradition and a reading of Brāhmī letters on a figure that has implications for our understanding of the history of Indian writing.

The essays of the fourth part are on the notions of space and the design of early temples, the Garbha Upaniṣad, deeper connections between ritual, masks, and sacrifice, and logic in Indian thought.

The fifth part begins with an essay on early architecture followed by material on art and cosmology and idea of Pāṇini and Bharata Muni on grammar and art. There

is an additional essay on the architecture of the inner cosmos as described by the Śrī Cakra.

The last part of the book is devoted to science and consciousness. It begins with a brief history of Indian science and how it has influenced moden science in surprising ways. There is a chapter on the history of Indian physical and chemical thought with focus on the Vaiśeṣika system. The very last essay is a proof of the existence of Īśvara in the perspective of contemporary physics and computer science.

The original publication information is provided on the first page of each essay. The published material has only been corrected for typographical errors and the selection has been made to keep the overlap in the material to a minimum. The style across the essays is not always consistent since the publication requirements of different journals are often different.

Stillwater
May 2, 2022

PART 1

OVERVIEW

1
The Secret of the Veda*

INTRODUCTION

Most people are perplexed about the Vedas. Very few have read them, and those who have find them difficult to understand. They can't make sense of its many divinities, sacrifices, rituals, riddles and paradoxes.

They are also confused by the praise showered on them by outsiders. Here're just a few quotes (from hundreds to be found in the literature):

> *Arthur Schopenhauer:* "Vedas are the most rewarding and the most elevating book which can be possible in the world."
>
> *Henry David Thoreau:* "Whenever I have read any part of the Vedas, I have felt that some unearthly and unknown light illuminated me. In the great teaching of the Vedas, there is no touch of sectarianism. It is of all ages, climes, and nationalities and is the royal road for the attainment of the Great Knowledge. When I read it, I feel that I am under the spangled heavens of a summer night."
>
> *J. Robert Oppenheimer*: "Access to the Vedas is the greatest privilege this century may claim over all previous centuries."

The reader of the Veda wonders why these (and other countless) luminaries say nice things about the Vedas when they can't see that in the translations of the texts or the interpretations they learnt in school and college.

Writing nearly 80 years ago, the great scholar Ananda Coomaraswamy wrote this of accounts of Hinduism by Western scholars and their Indian followers:

> "[A]lthough the ancient and modern scriptures and practices of Hinduism have been examined by European scholars for more than a century, it would be hardly an exaggeration to say that a faithful account of Hinduism might well be given *in the form of a categorical denial of most of the statements that have been made about it, alike by European scholars and by Indians trained in our modern skeptical and evolutionary modes of thought*." [emphasis added] (Coomaraswamy, 1943)

Repeated countless times over the past eighty years, these translations and interpretations form the foundation of instruction, public policy, and the practice of law. Deracinated Indians have internalized it and sincerely believe it to be the truth.

Most dismiss such translations by believing that true meaning can only be attained after a life time of sādhanā, or spiritual practice, under the guidance of a qualified Guru.

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* Oklahoma State University (2018) and Academia.edu (2021)

Over a hundred years ago, Sri Aurobindo wrote essays interpreting the Vedas but when asked to issue the material in 1949 in a book form he thought a revision was essential: "The publication of the Secret of the Veda as it is does not enter into my intention. It was published in a great hurry and at a time when I had not studied the Rig Veda as a whole as well as I have since done. Whole chapters will have to be rewritten or written otherwise and a considerable labour gone through; moreover, it was never finished and considerable additions in order to make it complete are indispensable."

He died the following year without attending to the revision, and the original material was put together in the form of a book in 1956 under the title *The Secret of the Vedas with Selected Hymns*, which has now been made freely available by the Ashram (Aurobindo, 1996). Meanwhile, popular translations and interpretations have continued to repeat old incorrect theories.

The problem is that *literally all academic translations of the* Vedas *are unsound*. They may be faithful in literal rendition but mostly the deeper and contextually correct meanings elude them. The difficulties of interpretation were pointed out by Yāska in his Nirukta nearly 3,000 years ago:

> Sanskrit: *tat ko vṛtraḥ? — meghaḥ iti nairuktāḥ, tvāṣṭro 'suraḥ ity aitihāsikāḥ* (Nirukta 2.16)
> English: *"That (who) Vṛtra?" — "A cloud" says the narrator, "An asura, Tvaṣṭri's [son]" say the storytellers.*

Generally, the cloud is not in the outer sky but in the inner one, and the asura is not a demon but a certain cognitive agent. Academic translations present infantilizing narratives that Yāska warned against because the authors don't get it. These translations are like the map of a city made by a blind mouse using odor alone, which may be accurate in the depiction of the many pathways and the relationship between them, but totally missing the broader or deeper picture.

If the translators only paid attention to the interpretative mechanisms within the tradition, they wouldn't be so wrong. The tradition says that the understanding has three layers: *ādhibhautika* आधिभौतिक (related to the body), *ādhidaivika* आधिदैविक (related to cognitions within the mind), and *ādhyātmika* आध्यात्मिक (related to the ātman, or consciousness). The first is for children, the second for people focused on doing things and making sense of change, and the third for the deep understanding of reality. The academic translations present the Veda at the level of kindergarten stories.

Schoolbook narratives informed by a surface understanding meant for children have misinformed several generations of students.

THE FIRST MANTRA

In order to explain the secret of the Veda, I take the very first mantra of the Ṛgveda:

अग्निमीळेपुरोहितंयज्ञस्यदेवं ऋत्विजं |
होतारंरत्नधातमम् | | (ṚV. 1.1.1)

Here's the translation people see on the Internet:

> *I laud Agni, the chosen Priest, God, minister of sacrifice,*
> *The hotar, lavishest of wealth*. (Translated by Ralph T.H. Griffith, 1896)

Agni is fire, but how can it be Priest, God, minister of sacrifice, and the rest that follows. And why is it important to have a priest or minister of sacrifice? What is the meaning of sacrifice? What is God, if we don't see him anywhere? Why is Agni "God" and why is lauding him important or relevant? Why speak of things that cannot be tested?

It is a jumble of words that takes you nowhere. You stop and give up.

DEEPER MEANING

We must first understand who Agni is. To the uninitiated, Agni is the physical fire that one can see. The deeper meaning of Agni is the light (or spark) within that lifts the veil on the lamp of consciousness; yet another meaning is Vāc or speech.

Agni and Vāc are two manifestations of the same deeper reality. This is expressed in the poetic expression that Vāc and Agni both reside in the waters and in trees. The waters of materiality hide the spark of Agni and the sounds of their waves; from trees comes fire as well as the wood for flutes and other musical instruments. There is a deeper connection between the elements of *tejas* (fire) and *vāyu* (air) that is explained by the Vaiśeṣika Sūtra that has had a surprising influence on contemporary science. [Note 1]

Devam, translated by Griffith as "God", is from the root div which means light, and the devas are the cognitive centers in the mind. [Note 2]) The word "God" is meaningless here excepting in its primary meaning of Light. The devas are the centers of agency that are the constituents of our mind.

So here is the deeper meaning of words and the translation is:

> *I praise Agni, the priest* [purohita] *who is the light* [devam] *and the invoker* [ṛtvij] *of the sacrifice, whose chants* [hotṛ] *bestow treasure.*

Imagine that your habits and conditioning have thrown a veil on your consciousness, by making you only see what you are familiar with. This veil can be penetrated by using the human manifestation of fire (that is speech of Agni, the *purohita* in the chants as *hotṛ*) to connect with the inner spark (*devam*), so that the covering is dissolved and one is in touch with one's true self.

The veil is only momentarily lifted just like one is only momentarily in the present moment. Most of the time, we inhabit either our past (which is dead and gone) or make dreams about the future (which doesn't exist). The idea of spiritual practice is to make that dissolution of the veil persist for ever longer period of time. How to do it is the practice of yoga.

Agni as in Ṛgveda 4.58.3

The process of connecting from speech to inner light needs a bridge and that is the mysterious role of Agni as invoker. Why mysterious? Because we are not talking of things, but rather of the workings of consciousness, which is not a material entity. This process of invocation requires a mastery of the processes that are symbolized by the Goddess.

It reeks of mystery since we use Agni (speech) to connect to the inner Fire in a process that takes us beyond the act of sacrifice.

What about treasures that are bestowed? The journeying to the source is transformative, and it is also *punarjanma*n, the rebirth, the end of the *yajñá*, the sacrifice. When connected to the source, capacities that lay latent, come alive. The treasures that one comes by were within one's reach all along, excepting one wasn't aware of them, or one didn't know where to look for them.

The process also reveals the many levels at which one can connect to reality. These are the various *lokas*, planes of existence or worlds (the English word look is a cognate), whose knowledge and mutual relationships help one navigate through different aspects of experience making it possible for one to master the world through *saṅkalpa*.

In physics, it is like the directing of evolution by observation. [Note 3]

What are the many divinities of the Ṛgveda? These are the lights at different points in the inner space of the mind, the embodiments of various cognitive capacities.

If you use your senses at the deepest level to connect to the self, you are going from the fire to the heart of the senses to the inner sun. If your focus is on the transformative processes within the inner cosmos, then this energy is Devi. If your desire is to follow to the root of your consciousness through a path of auspiciousness and equanimity, then the divinity is Śiva. *There are any number of points of light that one may name variously that take us to the Source.* These are not competing but complementary paths.

What is the origin of this desire? It is one's innate temperament and the milieu in which one is raised. There are different kinds of sādhanā to practice which are described in the Vedic texts, which are truly a manual of universal spiritual science or *ātma-vidyā*.

One may even provide this free translation: *I praise the spark [of insight], riding my chant, that becomes light and invokes a transformation in me bringing me new powers.*

The praise of Agni is to fortify oneself in one's faith in this process of self-

transformation. The rest of the hymn unpacks the attributes of Agni and speaks of how invoking it has worked in the past and how it will bring well-being in the future.

Just the first mantra of the Ṛgveda opens up an entire world of wisdom and insight. This is the doorway to the secret of the Veda. [Note 4]

AGNI, INDRA, SURYA

Each maṇḍala of the Ṛgveda (excepting 9, which is dedicated solely to Soma) begins with a hymn to Agni. The spiritual practice takes stock of the body or the earth (whose presiding deity is Agni, both in its fire and speech aspects), moves on to hymns invoking the prāṇa or the atmosphere (with the deity Indra who represents the senses that we must use to navigate through the mind), and finally to hymns that invoke the sun or the lamp of consciousness (Sūrya in its external aspects which shines in any number of pots of water generating an apparent multiplicity behind which lies a unity). In Vājasaneyi Saṃhitā 16.2, Agni has two forms, the fierce Rudra and the auspicious Śiva.

This triplicate order views privileges movement and thus constitutes the sacred theatre of the external ritual. When the ritual is done within the inner space, the three are mapped into divinities with which the *sādhaka* can have a more personal relationship.

DEVI, ŚIVA, VIṢṆU

Agni, in its manifestation as speech, the Goddess Vāc, is transformative and since the body is the ground, it interpenetrates into the higher fields or *lokas*. Indra, the lord of the senses — the mind — viewed at a higher level of abstraction is assimilated into Śiva with many layers of consciousness. The solar deity is invoked as Viṣṇu, whose upholding of the Moral Law is represented by his three strides the span the world. The transformative energy manifests together with Śiva and Viṣṇu as Pārvatī and Lakṣmī.

The exploration of the inner cosmos is Tantra that helps one discover the inner architecture of one's self and its relationship with the outer world.

SOMA

The entire ninth maṇḍala of the Ṛgveda is devoted to *Sóma Pávamāna*, "purifying Soma", that has mostly been seen as the pressing of the drink of the same name from a plant. Beyond this, Soma represents the moon but also sometimes Viṣṇu or even Śiva (as Somanātha).

The moon is lit and nourished by the sun; it is the mind which is illumined by the lamp of consciousness. Since the individual 's self-identification is with the mind, it is in the moon where the divine nectar of immortality resides. The pressing of the Soma is the purification of the mind, mirrored in the sacred theatre of the pressing of the herb that it makes it possible to connect to the heart of one's being.

With the above understanding of the purification of the mind, it is easy to see the logic of the symbolic rebirth of the consecrated man at the beginning of the Soma rite that is described in the Aitareya Brāhmaṇa 1.3. Both Suśruta and Caraka in their Ayurveda texts speak of rejuvenation through Soma, hinting at both the use of the purification of the mind

and the power of the herb.

THIRTY-THREE DIVINITIES

The Bṛhadāraṇyaka Upaniṣad has a dialog that deals with the question of the number of divinities. The great sage Yājñavalkya is asked: "How many gods?" He answers: "Three hundred and three, and three thousand and three". This question is repeated and this time Yājñavalkya says: "Thirty-three gods." On further questioning, Yājñavalkya says that they are six, and then three and then two and then one and a half, and finally one.

> *atha hainam vidagdhaḥ śākalyaḥ papraccha: katy devāḥ, yājñavalkya, iti. sa haitayaiva nividā pratipede, yāvanto vaiśvadevasya nividy ucyante; trayaś ca trī ca śatā, trayaś ca trī ca sahasreti. aum iti. hovāca, katy eva devāḥ, yājñavalkya, iti. trayaś triṁśad iti. aum iti. hovāca, katy eva devāḥ, yājñavalkya, iti. ṣaḍ iti. aum iti. hovāca, katy eva devāḥ, yājñavalkya, iti. traya iti. aum iti. hovāca, katy eva devāḥ, yājñavalkya, iti. drāv iti. aum iti. hovāca, katy eva devāḥ, yājñavalkya, iti. adhyardha iti. aum iti. hovāca, katy eva devāḥ, yājñavalkya, iti. eka iti, aum iti, hovāca katame te trayaś ca trī ca sahasreti.*

Yājñavalkya explains it further by saying: "The three thousand and all that I mentioned — they are not really gods. They are only manifestations of the thirty-three. "But what are these thirty-three?" *katame te trayas triṁśad iti*. "The thirty-three gods are eight Vasus, eleven Rudras, twelve Ādityas — they make thirty-one (*ekatriṁśat*) — then Indra and Prajāpati — these make thirty-three gods."

Eight Vasus (deities of material elements): The representations of the five elements, the stars, the Sun, and the Moon.

Twelve Ādityas (personified deities): The names of the Sun for each of the twelve months. These include Mitra and Varuṇa (mitrā́váruṇā), the representatives of ṛta ऋत, the natural law, who in context mean the beginning of summer and winter months.

Eleven Rudras (aspects of Consciousness): Five aspects of the mind: Ānanda "bliss", Vijñāna "knowledge", Manas "thought", Prāṇa "breath", and Vāc "speech", and five aspects of Consciousness (Śiva) — Īśāna (Citta Śaktī, power of grace, unveiling), Tatpuruṣa (Ānanda Śaktī, power of bliss, concealment), Aghora (Jñāna Śaktī, dissolution of false knowledge), Vāmadeva (Citta Rūpa, the sky of memories), and Sadyojāta (Icchā Śaktī, power of will, creation), and, finally, Ātman or "Self". [Note 5]

YOGA

The practice that opens the doorways to intuition promised in the Veda is Yoga; they are the two sides of the same understanding.

युञ्जते मन उत युञ्जते धियो विप्रा विप्रस्य बृहतो विपश्चितः। Ṛgveda 5.81.1

The learned yoke the mind, also yoke the thoughts in wisdom's vast inspiration.

Holding the thoughts is dhyāna, ध्यान. If one looks at the sequence of thoughts arising out of intuition (paśyan पश्यन्, e.g. Ṛgveda 1.88.5c or 10.124.3a) that through an intermediate stage मध्यमा is transformed to वैखरी words, then the process of going back to that intuition is vipaśyana.

तां योगमिति मन्यन्ते स्थिरामिन्द्रियधारणाम् ।
अप्रमत्तस्तदा भवति योगो हि प्रभवाप्ययौ ॥ ११ ॥ Kaṭha Up 2.3.11

Yoga is this firm holding back of the senses.
One is then calm, for Yoga is the source and the meeting.

THE FIRE RITUAL

The first hymn of the Ṛgveda is often chanted at the yajñá, the fire ritual. This is sacred theatre whose aesthetics together with the engaging of the senses by the fire, the sound, the burning incense, and the touch of air on the body facilitates going into an experience that is not normally accessible. While watching the fire, the participant is one with the Agni-twin of the fire, namely the chant, and thus become part of the performance.

The outer ritual is the beginning, the preparation for the inner ritual, at another moment or place, where one may chant or be one with the prāṇas to actually course through the mind's sky to marvel at the vault and explore the caves that it covers.

In performing the ritual within, the fire is replaced by sound and then by thought alone. One finds the points of power within and realizes that the deities are not abstractions. The Brahmā, Viṣṇu and Rudra *granthis* or knots (ब्रह्मा, विष्णु, रूद्र ग्रन्थि) are specific loci up the spinal column concerning creation, harmony, and experience. To journey through this space one must become one with the process, which is the working of the Goddess. The divinities shine through in this journey.

AN IMAGE OF AGNI

The Pateshwar Temple in Maharashtra has an astonishing image of Agni in the mystical description of Ṛgveda 4.58.3:

चत्वारि शृङ्गा त्रयो अस्य पादा द्वे शीर्षे सप्त हस्तासो अस्य ।
त्रिधा बद्धो वृषभो रोरवीति महो देवो मर्त्याँ आ विवेश ॥३॥

Four are his horns, three are the feet; two heads, and his hands are seven
Triply-bound, the Bull roars loudly, the God has entered into mortals.

Agni at Pateshwar Temple (photography by Kevin Standage)

This extraordinary image can be seen either as a bull or as a cross-legged human.

Seven Short Ṛgvedic Hymns with Translation

These short sūktas are amongst the most popular ones in the Ṛgveda and will thus be of interest to many readers. I also separately discuss the famed Gāyatrī mantra.

Ṛgveda 1.1
To Agni

॥ ऋग्वेदः सूक्तं १.१ ॥

ॐ अग्निमीळे पुरोहितं यज्ञस्य देवम् ऋत्विजम् ।
होतारं रत्नधातमम् ॥ १ ॥
अग्निः पूर्वेभिर्ऋषिभिरीड्यो नूतनैरुत ।
स देवाँ एह वक्षति॥ २ ॥
अग्निना रयिमश्नवत पोषमेव दिवेदिवे ।
यशसं वीरवत्तमम् ॥ ३ ॥

अग्ने यं यज्ञमध्वरं विश्वतः परिभूरसि ।
स इद्देवेषु गच्छति ॥ ४ ॥
अग्निर्होता कविक्रतुः सत्यश्चित्रश्रवस्तमः ।
देवो देवेभिरा गमत् ॥ ५ ॥
यदङ्ग दाशुषे त्वमग्ने भद्रं करिष्यसि ।

तवेत् तत् सत्यमङ्गिरः ॥ ६ ॥

उप त्वाग्ने दिवेदिवे दोषावस्तर्धिया वयम् ।
नमो भरन्त एमसि ॥ ७ ॥
राजन्तमध्वराणां गोपाम् ऋतस्य दीदिविम् ।
वर्धमानंस्वे दमे ॥ ८ ॥
स नः पितेव सूनवेऽग्ने सूपायनो भव ।
सचस्वा नः स्वस्तये ॥ ९ ॥

Translation Rgveda 1.1
I praise Agni, the priest who is the light and the invoker of the sacrifice, whose chants bestow treasure. 1

Agni, worshipped by former sages and new ones also,
conducts the devas here. 2

By Agni was brought wealth and prosperity day by day,
glory and great heroes. 3

Agni, what worship and sacrifice you pervade on every side,
that indeed goes to the devas. 4

May Agni, the invoker, poet's power, truth, beauty, most fame,
come with the devas. 5

Whatever is praised by you, Agni, is made auspicious,
and, through you, Aṅgiras, it shall revert to you. 6

To you, Agni, we come day by day, by dusk and dawn,
bringing praises and homage. 7

To you, O King over sacrifices, shining protector of the laws,
growing in your own house. 8

To us, like father to son, Agni, be easy to find,
accompany us to our well-being. 9

Notes
1. *Purohita*, *ṛtvij*, and *hotṛ* are priests associated with the fire-ceremony. Formally, the *adhvaryu* is the performer of the material part of the sacrifice; the *udgātṛ* is the chanter of the hymns; and the *hotṛ* is the reciter of the sacrificial mantras; and the *brahman* is the superintendent of the sacrifice. The *hotṛ* is associated with the Ṛgveda, the *adhvaryu* with the Yajurveda, and the *udgātṛ* with the Sāmaveda, and they represent the earth (body),

atmosphere (*prāṇas*), and the heavens (inner sun), respectively. The terms *purohita* and *ṛtvij* can represent any priest at the ceremony.

The first verse appears to invoke the priest in three functions that parallel the tripartite nature of our objective and subjective worlds. It also indicates that, mystically, the priests as well as the physical fire and the deity (*agni*) are the same during the ceremony; *īḷ* means to praise or worship. The *yajña* need not be only the fire ceremony; it represents any transformative process, or any act that leads to transcendence.

2. The worship of Agni is described as part of an old tradition; *vakṣati* is from *vah,* which is "to lead, carry," or from *vakṣa,* chest, that grows with the breath.
3. This repeats the promise of wealth and fame.
4. The ceremony is viewed as being essential to success.
5. The gods come with Agni; *kavikratuḥ* is the poet's power.
6. Describes the auspicious power of Agni and equates him to the ancient Ṛṣi Aṅgiras, but this is a play on the return of the gifts to the world for Aṅgiras represents the coals (*aṅgārāḥ*) that support the fire.
7. Agni is compared with the sun; *doṣā-vastar*, dispeller of gloom or by dawn and dusk.
8. Described as the guardian of the laws (*gopām ṛtasya*).
9. Agni is approached as father and lord (*pitā*) by the supplicant, the son (*sūnu*), and asked to bless the participants in the sacrifice.

Ṛgveda 3.62
To Indra and Varuṇa

॥ ऋग्वेदः सूक्तं ३.६२ ॥

इमा उ वां भृमयो मन्यमाना युवावते न तुज्या अभूवन् ।
क्व त्यदिन्द्रावरुणा यशो वां येन स्मा सिनं भरथः सखिभ्यः॥ १ ॥
अयमु वां पुरुतमो रयीयञ्छश्वत्तममवसे जोहवीति ।
सजोषाविन्द्रावरुणा मरुद्भिर्दिवा पृथिव्या शृणुतं हवं मे ॥ २ ॥
अस्मे तदिन्द्रावरुणा वसु ष्यादस्मे रयिर्मरुतः सर्ववीरः।
अस्मान्वरूत्रीः शरणैरवन्त्वस्मान्होत्रा भारती दक्षिणाभिः ॥ ३ ॥

बृहस्पते जुषस्व नो हव्यानि विश्वदेव्य ।
रास्व रत्नानि दाशुषे ॥ ४ ॥
शुचिमर्कैबृहस्पतिमध्वरेषु नमस्यत ।
अनाम्योज आ चके ॥ ५ ॥
वृषभं चर्षणीनां विश्वरूपमदाभ्यम् ।
बृहस्पतिंवरेण्यम् ॥ ६ ॥

इयं ते पूषन्नाघृणे सुष्टुतिर्देव नव्यसी ।
अस्माभिस्तुभ्यं शस्यते ॥ ७ ॥
तां जुषस्व गिरं मम वाजयन्तीमवा धियम् ।

वधूयुरिव योषणाम् ॥ ८ ॥
यो विश्वाभि विपश्यति भुवना सं च पश्यति ।
स नः पूषाविता भुवत् ॥ ९ ॥

तत सवितुर्वरिण्यं भर्गो देवस्य धीमहि ।
धियो यो नः प्रचोदयात् ॥ १० ॥
देवस्य सवितुर्वयं वाजयन्तः पुरन्ध्या ।
भगस्य रातिमीमहे ॥ ११ ॥
देवं नरः सवितारं विप्रा यज्ञैः सुवृक्तिभिः ।
नमस्यन्ति धियेषिताः ॥ १२ ॥

सोमो जिगाति गातुविद देवानामेति निष्कृतम् ।
ऋतस्य योनिमासदम् ॥ १३ ॥
सोमो अस्मभ्यं द्विपदे चतुष्पदे च पशवे ।
अनमीवा इषस्करत् ॥ १४ ॥
अस्माकमायुर्वर्धयन्नभिमातीः सहमानः ।
सोमः सधस्थमासदत् ॥ १५ ॥

आ नो मित्रावरुणा घृतैर्गव्यूतिमुक्षतम् ।
मध्वा रजांसि सुक्रतू ॥ १६ ॥
उरुशंसा नमोवृधा मह्ना दक्षस्य राजथः ।
द्राघिष्ठाभिः शुचिव्रता ॥ १७ ॥
गृणाना जमदग्निना योनावृतस्य सीदतम् ।
पातं सोमं ऋतावृधा ॥ १८ ॥

Translation Ṛgveda 3.62
Those wandering about were not pushed from their youthful course,
and with glory you, Indra-Varuṇa, empowered your friends. 1

This best man, seeking riches, constantly invokes your favor,
so, Indra-Varuṇa and the Maruts, with heaven and earth, hear you my invocation. 2

Let us have, Indra and Varuṇa, this treasure, and let us have, O Maruts, wealth and heroes,
may our shelter be with the goddess, and our language be our complete invocation. 3

Bṛhaspati, be pleased with our offerings, you loved of the gods,
and give jewels to one who brings you gifts. 4

The sacred sacrifices, O Bṛhaspati, with hymns we worship
I pray for unyielding power. 5

For the best people, trustworthy, the embracer of each form at will,
Is Bṛhaspati, most excellent. 6

Divine, resplendent Pūṣan, this our newest hymn of eulogy,
is chanted forth for you. 7

Accept with favor my song, be gracious to my thought,
as a bridegroom to his bride. 8

May he who sees all living things, see them all together,
may he, Pūṣan, be our protector. 9

That supreme light, divinity's splendor, may we embrace,
so our minds are inspired.10

May divinity's splendor make our understanding bountiful,
lead to our share of prosperity.11

People worship the creative light with rites and proper hymns,
inspired by the impulse of their thoughts.12

Soma goes forth to the gathering place of gods,
let us seat him at the source of law.13

To us and to our animals, may Soma give good energy,
to bipeds and to quadrupeds.14

Increasing our life, and conquering our foes,
may Soma, in our assembly take his seat.15

May Mitra-Varuṇa provide us meaning,
and honey for the regions of the air.16

Praised by many, O most powerful, dexterously you rule
with everlasting sacred laws.17

Praised by Jamadagni's song, sitting in the place of sacred law,
drink Soma, you who strengthens the law. 18

Notes

This hymn is for inspiration, for having faith in oneself. Indra and Varuṇa are the divine powers of the breath and the waters that lie beyond breath within oneself.

3. Varūtrī (वरूत्री), a guardian goddess

Ṛgveda 7.103
To the Frogs

॥ ऋग्वेदः सूक्तं ७.१०३ ॥

संवत्सरं शशयाना ब्राह्मणा व्रतचारिणः ।
वाचं पर्जन्यजिन्वितां प्र मण्डूका अवादिषुः ॥ १ ॥

दिव्या आपो अभि यदेनमायन् दृतिं न शुष्कं सरसी शयानम् ।
गवामह न मायुर्वत्सिनीनां मण्डूकानां वग्गुरत्रा समेति ॥ २ ॥

यदीमेनाँ उशतो अभ्यवर्षीत्तृष्यावतः प्रावृष्यागतायाम् ।
अख्खलीकृत्या पितरं न पुत्रो अन्यो अन्यमुप वदन्तमेति ॥ ३ ॥

अन्यो अन्यमनु गृभ्णात्येनोरपां प्रसर्गे यदमन्दिषाताम्।
मण्डूको यदभिवृष्टः कनिष्कन्पृश्निः सम्पृङ्क्ते हरितेन वाचम् ॥ ४ ॥

यदेषामन्यो अन्यस्य वाचं शाक्तस्येव वदति शिक्षमाणः ।
सर्वं तदेषां समृधेव पर्व यत्सुवाचो वदथनाध्यप्सु ॥ ५ ॥

गोमायुरेको अजमायुरेकः पृश्निरेको हरित एक एषाम्।
समानं नाम बिभ्रतो विरूपाः पुरुत्रा वाचं पिपिशुर्वदन्तः॥ ६ ॥

ब्राह्मणासो अतिरात्रे न सोमे सरो न पूर्णमभितो वदन्तः ।
संवत्सरस्य तदहः परि ष्ठ यन्मण्डूकाः प्रावृषीणं बभूव॥ ७ ॥

ब्राह्मणासः सोमिनो वाचमक्रत ब्रह्म कृण्वन्तः परिवत्सरीणम् ।
अध्वर्यवो घर्मिणः सिष्विदाना आविर्भवन्ति गुह्या न के चित् ॥ ८ ॥

देवहितिं जुगुपुर्द्वादशस्य ऋतुं नरो न प्र मिनन्त्येते ।
संवत्सरे प्रावृष्यागतायां तप्ता घर्मा अश्नुवते विसर्गम्॥ ९ ॥

गोमायुरदादजमायुरदात्पृश्निरदाद्धरितो नो वसूनि ।
गवां मण्डूका ददतः शतानि सहस्रसावे प्र तिरन्त आयुः ॥ १० ॥

Translation Ṛgveda 7.103
Having lain quiet for a year, like the Brāhmīns keeping their vow, the frogs have raised their voice that Parjanya has inspired. 1

From the heavens the waters came down like the dried leather sheet on the pool, then the croaking of the frogs join in unison like the lowing of cows with calves. 2

The rainy season having arrived, and water coming down on those who are waiting and thirsting for it, one approaches another who calls to him with satisfaction, as a son approaches his father. 3

The one greets the other as they revel in the waters that came forth, and frogs leap about under the falling drops, the speckled joining his voice with the green. 4

As one repeats the words of the other, like a pupil of the teacher, they seem to expand, chanting with fine sounds over the waters. 5

One lows like a cow, the other bleats like a goat; one is speckled, another green. They have the same name but their forms differ much, and as they speak they modulate their voices in diverse ways. 6

Like Brāhmīns at the overnight sacrifice who talk around the full bowl of Soma, so you frogs around the pool celebrate the first day of the year of the coming of rain. 7

Brāhmīns with Soma speak loud, offering prayers for this year long rite; the Adhvaryus come forth with their kettles, sweating, and nothing remains hidden. 8

Having kept the sacred order of the twelve month, these people do not overlook the season. The period of the rains has come, after a year, and those with heated kettles gain freedom. 9

He who bellows like a cow has given, he who bleats like a goat has granted, the speckled one, the green one has given us riches. By giving hundreds of insights, the frogs have added to our life in a thousand Soma-pressings. 10

Notes
Parjanya: Name for Indra as deva of the rains. This hymn is not only an evocative description of the scene at the pool with the croaking of the happy frogs on the first day of the rains after the hot and long summer, it also describes recursion, one of the central insights of the Vedas. The idea being stressed is that there is natural law, which is seen externally amongst the frogs reveling in the rains, but also in the rites of the Brāhmīns.

10. The *gavah* that the play of the frogs provides us are not the "cows" as is usually translated without making any sense, but rather the "insight" they provide about recursion.

Ṛgveda 10.90: The Puruṣa Sūkta
To Puruṣa

॥ ऋग्वेदः सूक्तं १०.९०॥

सहस्रशीर्षा पुरुषः सहस्राक्षः सहस्रपात् ।

सभूमिं विश्वतो वृत्वात्यतिष्ठद दशाङ्गुलम् ॥ १ ॥
पुरुष एवेदं सर्वं यद भूतं यच्च भव्यम् ।
उतामृतत्वस्येशानो यदन्नेनातिरोहति ॥ २ ॥
एतावानस्य महिमातो ज्यायाँश्च पूरुषः।
पादो अस्यविश्वा भूतानि त्रिपादस्यामृतं दिवि ॥ ३ ॥
त्रिपादूर्ध्व उदैत्पुरुषः पादो अस्येहाभवत पुनः ।
ततो विष्वङ्व्यक्रामत्साशनानशनेअभि ॥ ४ ॥

तस्माद्विराळजायत विराजो अधि पूरुषः ।
स जातो अत्यरिच्यत पश्चाद्भूमिमथो पुरः ॥ ५ ॥
यत्पुरुषेण हविषा देवा यज्ञमतन्वत ।
वसन्तो अस्यासीदाज्यं ग्रीष्म इध्मः शरद्धविः ॥ ६ ॥
तं यज्ञं बर्हिषि प्रौक्षन्पुरुषं जातमग्रतः।
तेन देवा अयजन्त साध्या ऋषयश्च ये ॥ ७ ॥
तस्माद्यज्ञात्सर्वहुतः सम्भृतं पृषदाज्यम् ।
पशून्ताँश्चक्रे वायव्यानारण्यान्ग्राम्याश्च ये॥ ८ ॥

तस्माद्यज्ञात्सर्वहुत ऋचः सामानि जज्ञिरे ।
छन्दांसि जज्ञिरे तस्माद्यजुस्तस्मादजायत ॥ ९ ॥
तस्मादश्वा अजायन्त ये के चोभयादतः ।
गावो हजज्ञिरे तस्मात तस्माज्जाता अजावयः ॥ १० ॥
यत्पुरुषं व्यदधुः कतिधा व्यकल्पयन्।
मुखं किमस्य कौ बाहू का ऊरू पादा उच्येते ॥ ११ ॥
ब्राह्मणोऽस्य मुखमासीद्बाहू राजन्यः कृतः ।
ऊरू तदस्य यद्वैश्यः पद्भ्यां शूद्रो अजायत ॥ १२ ॥

चन्द्रमा मनसो जातश्चक्षोः सूर्यो अजायत ।
मुखादिन्द्रश्चाग्निश्च प्राणाद्वायुरजायत ॥ १३ ॥
नाभ्या आसीदन्तरिक्षं शीर्ष्णो द्यौः समवर्तत।
पद्भ्यां भूमिर्दिशः श्रोत्रात्तथा लोकाँ अकल्पयन् ॥ १४ ॥
सप्तास्यासन्परिधयस्त्रिः सप्त समिधः कृताः ।
देवा यद्यज्ञं तन्वाना अबध्नन्पुरुषं पशुम् ॥ १५ ॥
यज्ञेन यज्ञमयजन्त देवास्तानि धर्माणि प्रथमान्यासन् ।
ते ह नाकं महिमानः सचन्त यत्र पूर्वे साध्याः सन्ति देवाः ॥ १६ ॥

Translation Ṛgveda 10.90

Thousand heads has Puruṣa, thousand eyes, thousand feet,
he pervades the universe and ten fingers-wide beyond. 1

Puruṣa is this all, what is past and what is to be.
He is the lord of immortality, for he mounts beyond the world of food. 2

Such is his greatness, and yet greater is Puruṣa.
One-fourth of him is the beings, three-fourths immortals in the heavens. 3

Three-fourths of Puruṣa went above, but a quarter of him remained below.
From that he spread out everywhere, eating and fasting. 4

From that Virāj was born; from Virāj, Puruṣa.
When born, he extended beyond the earth, behind and in front. 5

When with Puruṣa as offering the gods made a sacrifice,
spring was its ghee, summer the fuel, autumn the offering. 6

In the sacrifice, the grass sprinkled, Puruṣa, born in the beginning,
with him the gods, the sādhyas and the rishis adored. 7

From that sacrifice an offering was brought together with ghee and milk;
it made the beasts, over whom Vayu presides, that are of the forest and the village. 8

From that sacrifice and offering, the hymns and chants were born;
the meters were created from it, and the *yajus* from it were born. 9

From it the horses were born and those with teeth in both jaws.
The cows were created from it; from it were born the goats and the sheep. 10

When they divided out Puruṣa, how many portions did they make?
What were his mouth, his arms, and what his thighs and feet were named? 11

His mouth was the brāhmaṇa, of his arms was made the rājanya,
his thighs became the vaiśya, from his feet the śūdra was born. 12

The moon from his mind arose, from his eye the sun was born;
from his mouth both Indra and Agni, from his breath Vāyu was born. 13

From his navel came the atmosphere, from his head the sky was fashioned;
earth from his feet, the directions from his ear. Thus they created the worlds. 14

Seven were the altar sticks; thrice seven fire sticks were made,
when the gods, offering the sacrifice, tied the Puruṣa. 15

The gods sacrificed with the sacrifice to the sacrifice; these were the first rites.
These reached the firmament, where the ancient sādhyas and the gods dwell. 16

Notes

1. Thousand implies uncountability, whereas ten-fingers width represents transcendence beyond the physical universe.
2. This idea of transcendence does not only cover the physical space, but also time.
3. The four parts of Puruṣa are the four divisions of the universe: earth, atmosphere, heavens that are paralleled in the body, prāṇa, and consciousness, together with the transcendent principle beyond. It is also mirrored in the four kinds of language, which later texts call *vaikhari, madhyamā, paśyantī*, and *parā,* that is, language without context (*vaikhari*), increasing to higher levels with intermediate (*madhyamā*) and deeper context (*paśyantī*), with transcendent speech (*parā-vāk*).
4. The significance of the proportion is clear from the previous verse.
5. This presents the location and birth of Puruṣa as an insoluble riddle.
6. Puruṣa as representing the universe recursively, since the ritual is played out also at the cosmic scale.
7. This adds to the paradox of the gods who are already there invoking Puruṣa, their Source.
8. The universe as seen emerging out of cosmic ritual, which is recreated by the individual.
9. The paradox of creation in a universe with rules is stressed here.
10. Lists elements of the evolution, indicating that each of these animals –like others that are not named – is perfect at its task.
11. The rhetorical question seeks answer to the extent of the universe both at the personal and the physical levels.
12. This verse should be considered together with the earlier numbers 5 and 6. Although it speaks of the four great classes (divided by function), it also implies that the four varṇa attributes reside within each individual. Just like the dance of Śiva occurs both at the universal or personal levels across time and space, so does the division of Puruṣa occur repeatedly within the individual. Thus the four varṇas are four colors of mind, born out of a mixing of the guṇas.

    The Puruṣa is within each of us, and therefore this means that when I am learning or teaching I am a brāhmaṇa, when I am fighting for my family or my nation I am a rājanya (kṣatriya), when I am providing for family and society I am a vaiśya, and when I do service at home or in society I am śūdra.
13. This indicates the correspondence between physiological and cosmic processes. Such correspondence has recently been confirmed by the science of biological cycles.
14. A further description of the equivalence of microcosm and macrocosm.
15. Here is a further numerical equivalence made between cosmic processes and the details of the altar ritual.
16. The phrase “the gods sacrificed with the sacrifice to the sacrifice” (*yajñéna yajñám ayajanta*) returns us to the central mystical and paradoxical aspect of the ritual as well as our reality.

Ṛgveda 10.129: The Nāsadīya Sūkta
To Bhāvavṛttam

॥ ऋग्वेदः सूक्तं १०.१२९॥

नासदासीन् नो सदासीत् तदानीं नासीद् रजो नो व्योमापरो यत् ।
किमावरीवः कुह कस्य शर्मन्नम्भः किमासीद् गहनं गभीरम् ॥ १ ॥
न मृत्युरासीदमृतं न तर्हि न रात्र्या अह्न आसीत्प्रकेतः ।
आनीदवातं स्वधया तदेकं तस्माद्धान्यन न परः किं चनास ॥ २ ॥
तम आसीत् तमसा गूळ्हमग्रेअप्रकेतं सलिलं सर्वमा इदम् ।
तुछ्येनाभ्वपिहितं यदासीत् तपसस्तन्महिनाजायतैकम् ॥ ३ ॥
कामस्तदग्रे समवर्तताधि मनसो रेतः प्रथमं यदासीत् ।
सतो बन्धुमसति निरविन्दन् हृदि प्रतीष्याकवयो मनीषा ॥ ४ ॥
तिरश्चीनो विततो रश्मिरेषामधः स्विदासीद् उपरि स्विदासीत् ।
रेतोधा आसन् महिमान आसन् स्वधा अवस्तात् प्रयतिः परस्तात् ॥ ५ ॥
को अद्धा वेद क इह प्र वोचत् कुत आजाता कुत इयंविसृष्टिः ।
अर्वाग् देवा अस्य विसर्जनेनाथा को वेद यताबभूव ॥ ६ ॥
इयं विसृष्टिर्यत आबभूव यदि वा दधे यदि वा न ।
यो अस्याध्यक्षः परमे व्योमन् सो अङ्ग वेद यदि वा नवेद ॥ ७ ॥

Translation Ṛgveda 10.129
Not non-existence was it nor existence was it then; there was no air nor the heavens beyond. What covered it? Where? By who sheltered? Was water there, an abyss unfathomable? 1

Neither death was there nor immortality then, not of night or day was there distinction. That alone breathed without air by its own power; apart from that there was none else. 2

Darkness it was, by darkness hidden in the beginning, an ocean without signs. Through the seed of all things that was enveloped in void, through the force of meditation thought was born. 3

Upon that in the beginning arose desire, which was the first impulse of that thought. This desire the sages saw as the link between existence and non-existence, upon searching with the intuition of their heart. 4

Transversely was their vision extended: what was above it, what was below? They were givers of life, powers they were, linked to the above, with impulse for below. 5

Who this knows? Who here will declare whence it was born, whence this creation? Later are the gods to the world's creation. Who then knows whence it came into being? 6

This creation, whence it came into being, whether it was formed or whether not. He who is

its lord in the highest heavens surely he knows, or perhaps he knows not. 7

Ṛgveda 10.135
To Yama

॥ ऋग्वेदः सूक्तं १०. १३५ ॥

यस्मिन वृक्षे सुपलाशे देवैः सम्पिबते यमः ।
अत्रा नोविश्पतिः पिता पुराणान् अनु वेनति ॥ १ ॥

पुराणाँ अनुवेनन्तं चरन्तं पापयामुया।
असूयन्नभ्यचाकशं तस्मा अस्पृहयं पुनः॥ २ ॥

यं कुमार नवं रथमचक्रं मनसाकृणोः ।
एकेषंविश्वतः प्राञ्चमपश्यन्नधि तिष्ठसि ॥ ३ ॥

यं कुमार प्रावर्तयो रथं विप्रेभ्यस्परि।
तं सामानु प्रावर्तत समितो नाव्याहितम् ॥ ४ ॥

कः कुमारमजनयद्रथं को निरवर्तयत्।
कः स्वित्तदद्य नो ब्रूयादनुदेयी यथाभवत् ॥ ५ ॥

यथाभवदनुदेयी ततो अग्रमजायत ।
पुरस्ताद् बुध्नाततः पश्चान निरयणं कृतम् ॥ ६ ॥

इदं यमस्य सादनं देवमानं यदुच्यते ।
इयमस्य धम्यते नाळीरयं गीर्भिः परिष्कृतः ॥ ७ ॥

Translation Ṛgveda 10.135
Yama.
[Boy:] At the leafy tree Yama drinks with the gods,
there the father, the lord of the house, invites us to join the men of old. 1

I looked sorrowfully at him for inviting me to join those of olden times
and walk with them, but then I yearned for it. 2

[Yama:] You climb, without seeing, O Boy, the new and wheel-less car
That you created in your mind, has one axle but it turns every way. 3

The car you have driven down in, O Boy, from the sages,
the Sāman followed close to return, and lay together as on a boat. 4

Who was the father of the boy? Who made the car roll away?
Who will announce to us today how the gift was made? 5

Just as the originator has existed, so is the first one born
As the ancient expanded its base, a space was then created. 6

[All:] Here is Yama's seat, that which is called the home of gods;
here musicians blow the flute for him, here he is glorified with songs. 7

Note
This hymn is a dialogue between Naciketā (of the Kaṭha Upaniṣad fame) and Yama.

Ṛgveda 10.191
To Agni

॥ ऋग्वेदः सूक्तं १०.१९१ ॥

संसमिद्युवसे वृषन्नग्ने विश्वान्यर्य आ ।
इळस्पदे समिध्यसे स नो वसून्या भर॥ १ ॥

सं गछध्वं सं वदध्वं सं वो मनांसि जानताम् ।
देवा भागं यथा पूर्वे संजानाना उपासते ॥ २ ॥

समानो मन्त्रः समितिः समानी समानं मनः सह चित्तमेषाम् ।
समानं मन्त्रमभि मण्त्रये वः समानेन वोहविषा जुहोमि ॥ ३ ॥

समानी व आकूतिः समाना हृदयानि वः ।
समानमस्तु वोमनो यथा वः सुसहासति ॥ ४ ॥

Translation Ṛgveda 10.191
Together and apart, mighty Agni, gather all that is good,
with the kindling of praises bring us treasures. 1

Walk together, speak together; let your minds know together;
the gods' share, as in ancient times, may you know in right places. 2

Common be the prayer, together in mind, with common purpose,
I approach you with the common prayer, and together offer you a common pujā. 3

Let the intentions be joined, and your hearts be together,
Together be you in thoughts, so you may live well. 4

Notes

1 *yuvase,* to separate; *arya*, good.
2 *devāḥ bhāgam,* the gods' share
3 *havis,* offering, *juhomi,* from *hu*, worship.
4 *ākūtiḥ*, intention.

Gāyatrī Mantra गायत्री मन्त्र

ॐ भूर्भुवस्वः ।
तत् सवितुर्वरेण्यं ।
भर्गो देवस्य धीमहि ।
धियो यो नः प्रचोदयात् ॥ ऋग्वेद ३.६२.१० ॥

That supreme light,
divinity's splendor, may we embrace,
so our minds are inspired. *Ṛgveda 3.62.10*

Line Translation:
(1) *tát savitúr váreṇyam*
That light supreme,

(2) *bhárgo devásya dhīmahi*
divinity's splendour, may we embrace,

(3) *dhíyo yó naḥ pracodáyāt*
so our minds are inspired.

Notes:
The invocation of *oṃ* and *bhūr bhuvaḥ svaḥ* expresses the Vedic intuition related to the recursive nature of reality. The syllable *oṃ* symbolically represents the cosmos as well *Brahman*. *Oṃ = a + u + m,* where "a" is the earth or body (*bhū)*, "u" is atmosphere or the *prāṇa*s (*bhuvas)*, and "m" is the heavens or the inner lamp of consciousness (*svar)*. This juxtaposition is to emphasize the centrality of *bandhu*, the fundamental binding across recursive layers of reality. The three *bhūr bhuvaḥ* and *svaḥ* are respectively being, becoming, and transcendence.

It stresses the agency of the individual in choosing light instead of the implied opposite, which is covering or darkness. But the very fact that such choice exists means that the phenomenal reality is dual. It also means that we are fundamentally free to make choices, and to create the world.

It is significant that light is described using three different words: *savitar*, *bhargaḥ,* and *devaḥ,* which indicate its locus in the three domains of the sky, the atmosphere, and the body (the *deva*s shine in the inner sky), that reinforces once again the triple *bandhu* already described in the invocation.

The inspiration of the mind and thoughts indicates transformation, stressing the

becoming of our lives.

Vocabulary:

oṃ the mystic sound.
bhū earth or the body
bhuvas atmosphere, or the *prāṇa*s, breaths
svar heavens, sky, or the inner light of consciousness.
tat that
savitúḥ genitive of Savitar or Savitā, the sun (outer as well as inner), light.
vareṇyam desirable, supreme
bhargaḥ glory, light, splendor
devasya genitive of *deva*, deity, lord, or divinity (from *div*, to shine)
dhīmahi may we embrace (first person, plural optative of *dhā,* "establish, embrace," which indicates more agency than the commonly used translation "attain")
dhíyaḥ thoughts, mind, being
yáḥ that, so
naḥ our
pracodáyāt inspired (*pra-*, prefix that means "everywhere," *cud,* verb meaning "to impel" or "send forth," causative, third person); see Śrīmad *Bhāgavatam 10.25.2* for comparison, where it means "sent forth".

GENERAL NOTES

1. It is the deeper connection between *tejas* and *vāyu* that prompted Swami Vivekananda to advice Nikola Tesla to look for an equation connecting matter and energy (Kak, 2017). Tejas as fire and vāyu as air (the others being earth, water and ākāśa) are not to be understood in their ordinary association but rather as two states of matter.
2. See (Kak, 2000) and (Pande, 2008). The latter book also gives translations of selected sūktas.
3. For Quantum Zeno Effect, see Misra and Sudarshan (1977) and Kak (2018).
4. With this paradoxical statements such as RV 1.164.50 become clear. One also sees the parallel with the Gāyatrī Mantra (RV 3.62.10). For a deeper discussion of yajñá, see Kak (2007).
5. The eleven Rudras find a systematic representation in the categories of Kashmir Śaivism, by getting added to the 25 tattvas of Sāṅkhya for the total of 36. Thus we see connections that go back to the Vedas.

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2

Life and Yoga*

INTRODUCTION

The earth is smaller than a speck of dust in the cosmos, so what do our lives mean? And while our senses guide us, how much can we trust them?

The first big problem is that of the body, our own and that of the physical universe. And what lies beyond the solar system and the stars?

The second big problem is that of change. Everything is in flux, so the images we form of ourselves and that of the universe can best be a snapshot, a frozen moment of time. There is the mystery of time. And then this: The brain is pitch dark; there is no light in it even when we look at things. There is no evidence for the naïve idea that somehow the image impinging on the retina is projected at the back of the head.

The third big problem is that of awareness and consciousness. We know we are conscious and our self-knowledge rests in our consciousness, but we don't know what it means.

Trying to make sense of what our life means we must first confront the problems of the body (B), transformation or change (T), and consciousness (C). We would like the intuitions related to B, T, and C to be in harmony.

This is quite similar to good health where at each systemic level there is balance between aggregation, change, and higher purpose. In Ayurveda these are the three doṣas of kapha, pitta, and vāta, which map to the abstractions related to the elements water, fire, and air.

We pull up memories from somewhere inside our heads. This is not an exact process for remembering is a little different each time. Memories are not only rehashes of what was experienced; more memories are generated in the mind. The sense of ownership of the memories is the ego. Since memories are not precise, and there are others that are imagined, we need intelligence to separate "good" memories from others that are made-up. All this complicates our reasoning.

To find answers to these three existential problems we go to college, find teachers and spiritual masters, or join a religious group for comfort.

THE ACADEMY

You rush off to college and enroll in this course or the other. You will find many brilliant

* Medium.edu (2020)

people there, and that's the place to go to learn about the world through its many academic disciplines.

But these disciplines exist in silos and as a rule academics lack an overarching understanding of the nature of reality. Many professors can only speak discipline-related jargon.

Everyone has heard the story of the elephant and six blind man. The one who feels the trunk says it is thick snake, the second one who feels the ear says it is kind of a fan, the third whose hand is on the leg calls it a tree-trunk, the fourth who is feeling its side says it is a wall, the fifth who is holding the tail calls it a rope, and finally the one feeling the tusk says it's kind of a spear.

Imagine now that each of these is represented by an academic discipline with its own peer-reviewed journals, where the professors mark their academic progress by the number of citations of the papers by others in their discipline, and academic leadership is measured by how aggressively you name-call holders of other views.

The chances you will find a professor who is able to teach you about the three big questions is at best slim, and most likely impossible.

I know of many bright young people who went to the best colleges and emerged from there with clouded minds, as angry individuals intolerant of views other than their own.

WISDOM COMMUNITIES

If not the academy, what about a wisdom community? But where to turn for that? Religion?

But many religions are only about conceptions of the body in this world and life in paradise, together with injunctions on what to wear, what to eat, who to socialize with and even what to think and believe? In other words, they are mostly B (but only grudgingly, because they reject much of academic science), with perhaps a dash of T, and literally no C. They don't address the big questions.

Philosophy? It was traditionally the study of general and fundamental questions about existence, knowledge, values, reason, mind, and language. It dealt with big questions, but no more. Western philosophy now is about the foundations of academic subjects related to social, economic, scientific and logical problems, which are important in their own right but barely scratch the surface as far as our inquiry is concerned.

Academic philosophy's sub-disciplines relate to evolution of knowledge and mind, but these approaches are essentially body-centric. An attempt to provide mechanical explanations that appeal to randomness and complexity, these approaches don't take one very far.

MIND AND YOGA

The mind is the mirror in which we perceive the world. But it is an active mirror, in which

the cognitive centers, that act like lights, appear to have agency. This is clear from syndromes caused by injury that render the individual incapable of reading while retaining the capacity to write (*alexia without agraphia*) [1]. It is as if the sky of the mind has an architecture that becomes the foundation of our psychological being.

But how many lights? We can use the mind's eye to count the lights that illuminate the inner sky. The word *yoga* means *union* and scholars define it as the union of the mind and one's consciousness, which we may call the self (Sanskrit *ātman*).

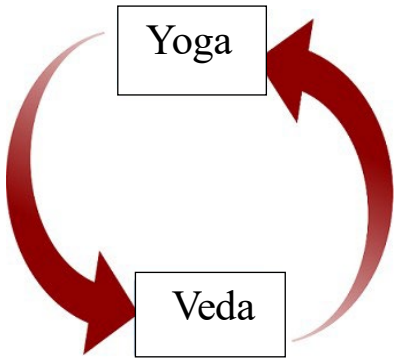
The difference between the mind and the self is rather subtle. The mind is the cognitions associated with judgement, language and memory that are mutually intertwined and underpinned by ego, whereas the self is *pure awareness* that is not colored by prior experience or emotional attachment to one's personhood.

The mind is the instrument that, energized by the ego, assumes that it is the real individual. In reality, there are many minds that show up in different situations, and each one of them is a secondary presence, just like the moon that reflects the light of the sun and waxes and wanes. The self is the inner sun (gold), whereas the mind is the moon (silver). The dialogue of the Bhagavad Gītā (a central text of Yoga) is between Krishna (Kṛṣṇa) as the sun and the Witness and Arjuna (the name means silver) who represents every person's mind.

By the *union* of the two one means the mind refashions itself so that, by techniques based on knowledge of its own nature, it is able to become one with the inner sun. It is helpful in this journey to prepare oneself by ethical behavior, truthfulness, compassion and empathy.

This knowledge is Veda and, specifically, it means the science of consciousness. The practice of Yoga requires the underpinning of the Veda, and, in turn, it leads to a deeper intuition of the knowledge. The two are a complementary pair.

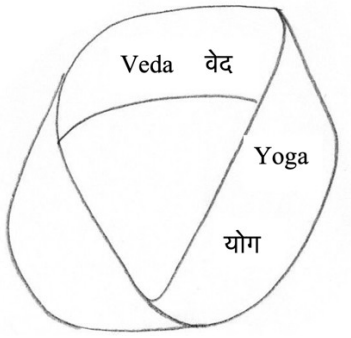
The practices of Veda, which are collectively the disciplines of Yoga, concern self-knowledge. What practice to do depends on the individual's temperament and life-experience.



The complementarity of Yoga and Veda

But once the insight deepens, it is realized they are more than a pair of exclusive categories and one transforms into the other. The have become like the two wings of the bird: both need to be flapped to soar high in the sky.

The dualities we confront in life are concerning the body and it changes (B- T) at one level, and transformations and their awareness (T-C) at another level. The practice of Yoga is to learn to bridge these dualities in one's experience and, doing so, obtain self-knowledge.



Yoga and Veda as two sides of the same thing

One begins by the purification of the elements that form the mind. This helps one find inner balance. It becomes clear that the self transcends the individual and is not merely an artifact that emerges from the electrical activity in the brain.

Now, of course, there are those in the academic world who say that the difference between the mind and the self is illusory and they take it that mind = self. They add: Whatever benefit accrues from Yoga is from its physical āsanas, and the changes in attitude and behavior resulting from the self-discipline it fosters. They assert that Yoga's analysis of the way thinking happens and such self-examination is helpful in achieving focus. Mathematics, music, dance or theatre may also facilitate a calm that leads to focus and creativity.

But Yoga claims that it offers much more than intellectual, emotional or psychological benefits, and the practitioner can also hope to access extraordinary knowledge and intuition about reality. At Yoga's end are answers about meaning of not just one's own life but the larger mystery of reality.

This possibility of this knowledge goes to the very heart of the difference between Yoga and Western approaches to the mind. Within the Indian tradition, scholars and masters are emphatic that the West doesn't quite get what Yoga has to offer to the world.

Before one can obtain a measure of one's mind, one needs to have a measure of one's body, therefore the Yogic practice includes *āsanas* (physical posture that facilitate wellness). This is followed by *prāṇāyāma* (breath exercises), *pratyāhāra* (in-drawing one's awareness), *dhāraṇā* (concentration), *dhyāna* (meditation), and *samādhi* (meditative

consciousness).

VEDIC VOCABULARY

To obtain mastery of Yoga, one needs an immersion in the Veda. Although most will warn you that it is an esoteric and difficult subject, it turns out to be perfectly understandable if approached correctly [2].

We mentioned before that the gods are the cognitive centers that define the architecture of consciousness. The word for light in Sanskrit is *div*, which is the root from which words such as divinity and *deva* emerge. The word "god" itself is from the Sanskrit "*sva-tava*" (self-powered). [3]

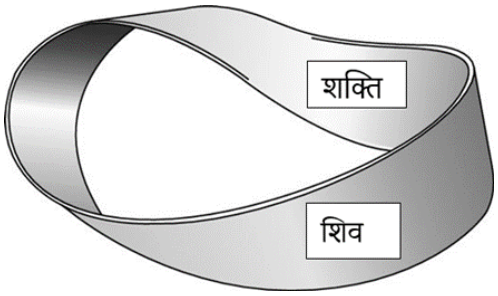
When anthropomorphized, gods and the goddesses are shown as having four arms that represent cardinal directions; there are other aspects that point to their cosmic forms, such as the sun and the moon as eyes. Since the workings can only be through embodiment, both Viṣṇu and Śiva each have a consort, the Goddess.

It speaks of the natural laws of the universe in the conception of Viṣṇu, who is aggregation of not the physical and biological laws but also the moral ones that make the world go (B).

Transformation and change caused by swirling energies is Śakti, who stands for embodiments both at the personal and the cosmic levels (T).

And, finally, consciousness that is within us as awareness and which endows one with freedom and will is (C).

Natural Law can be ascertained by studying Śakti. But it is a study where as more is known, what remains is the shadow, and as one bends down to catch its end, it only gets longer.



The complementarity of Śiva and Śakti

In symbolic form, Śiva is a pillar, an image inspired, no doubt, by the cosmic axis around which all stars revolve (a reflection of the spinning of Earth), and the psychological axis in our minds that lets us believe we are the same individual even as we change physically and in our memories.

There are many practices that facilitate the search for the inner light. The individual

body, and materiality in the large, is one way to find them. Śiva influences the world through observation and exercise of freedom.

My own translation of Patañjali's Yoga-sūtra discusses the relationship between Śiva and Śakti at length and shows it plays a central role in advanced Yogic practices [4].

SOME HISTORY

The conception of the mind in Patañjali's Yoga-sūtra is the same as that of the Ṛgveda which describes two birds on the tree of whom one is eating the fruit and the other merely watches. This resonates with the famous metaphor of the chariot in the Bhagavad Gītā, where the chariot is the body and its horses are the senses. The immature and unwise person is pulled by the horses; for the wise man it is not the senses that lead the chariot but rather the *witness* within who is the self.

The Veda promises intuition from the practice of Yoga:

युञ्जते मन उत युञ्जते धियो विप्रा विप्रस्य बृहतो विपश्चितः। Ṛgveda 5.81.1

yuñjate mana uta yuñjate dhiyo viprā viprasya bṛhato vipaścitaḥ |

The learned yoke the mind, also yoke the thoughts in wisdom's vast inspiration.

The mind acts in paradoxical ways: the unwise person feels he is free but isn't; the wise one appears to have no autonomy, but is free! The two birds of the Ṛgveda are the source of our two voices. For the unwise the two voices are different, but for the wise, the one who has practiced Yoga, the two merge into one and it is this union that was mentioned in the beginning.

There are many descriptions of yoga in the Mahābhārata, which is by all accounts anterior to Patañjali. In it, Sage Vasiṣṭha speaks of yoga as *ekāgratā*, one pointed concentration, and Bhīṣma instructs Yudhiṣṭhira in four stages of *dhyāna- yoga.* The Bhagavad Gītā speaks of four kinds of yoga: *karma-yoga*, the path of action, *jñāna-yoga*, the path of knowledge, *bhakti-yoga*, the path of devotion, and *dhyāna-yoga*, the path of meditation. The Kaṭha and the Śvetāśvatara Upaniṣads also speak of yoga.

In the Maitrī Upaniṣad, it is said that yoga has six *aṅgas* or limbs which are listed as *prāṇāyāma*, breath control, *pratyāhāra,* sense-withdrawal, *dhyāna*, meditation, *tarka*, logic, and *samādhi*, absorption. In the Bhagavad Gītā, there is much stress on *Sāṅkhya-yoga* (the *tattvas* and their relationships) which is taken to be the same as the yoga of knowledge; the Mokṣadharma Book of the Mahābhārata also says that Sāṅkhya and Yoga are one.

योगस्थः कुरु कर्माणि सङ्गं त्यक्त्वा धनञ्जय |
सिद्ध्यसिद्ध्योः समो भूत्वा समत्वं योग उच्यते || BG 2.48||

yogasthaḥ kuru karmāṇi saṅgaṃ tyaktvā dhanañjaya

siddhy-asiddhyoḥ samo bhūtvā samatvaṃ yoga ucyate

Steady in yoga, perform your actions, abandoning attachments, O Arjuna. To have achieved equanimity in success and failure is mark of yoga

योग: कर्मसु कौशलम् || BG 2.50||

yogaḥ karmasu kauśalam

Yoga is skill in action

As skill in action, yoga is a path of mastery in all fields.

VASIṢṬHA'S YOGA

The Yoga Vāsiṣṭha, another great classic of yoga that was put together most likely after the Yoga-Sūtras, is a dialog between a despondent young Rāma and the sage Vasiṣṭha. Rāma summarizes the sources of human suffering: impermanence, heartbreak, pain, illness, disease, and mortality, and complains that one cannot find happiness in things for they are like toys of which the child tires before long.

Vasiṣṭha's teaching is to seek higher planes in which one is attuned to the universal rhythms of life. In the universal frame, one is not different from others and, therefore, the cause of suffering vanishes. Vasiṣṭha concludes: "Between *this* and *that* is the body of consciousness: it is unity and diversity. Fullness expands in infinity; and then the infinite alone exists as the world. Wherever consciousness conceives of creation, materiality emerges. Indivisible consciousness exists everywhere, and all that is also this creation."

He adds that the subject exists because of the object, and the object is but a reflection of the subject. When real knowledge is gained, what remains is not expressible in words. Of that it cannot be said that it is one or that it is many. It is neither seer nor seen, neither subject nor object, neither this nor that.

YOGA AND HINDUISM

Yoga is the practice of Hinduism; it is the very heart of Sanātana Dharma. Some people are worried by this, but that is only because of the misunderstanding about the nature of Hinduism, which is a universal tradition of knowledge of the self.

What about the stuff that one reads on caste? "Caste" as a category was created by the British for their colonial ends [5]; it's not essential to Hinduism and it has been disavowed countless times. Hinduism is about radical equality since all sentient beings have the same Self (puruṣa).

Ritual is spiritual practice as sacred theatre that helps the participant in the process of self-discovery, but it is not required if one doesn't find its aesthetics in accord with one's temperament.

Yoga is one of the six darśanas (philosophies) associated with the Veda, which are the lenses through which one can make sense of reality. The Bhagavad Gītā, the central text of Yoga, is considered the most accessible summary of the Veda.

> योगयुक्तो विशुद्धात्मा विजितात्मा जितेन्द्रिय: |
> सर्वभूतात्मभूतात्मा कुर्वन्नपि न लिप्यते || BG 5.7||
> *yoga-yukto viśuddhātmā vijitātmā jitendriyaḥ*
> *sarva-bhūtātma-bhūtātmā kurvann api na lipyate*
> Yogis endowed with purified intellect, who control the mind and senses, see the Self in every living being. Actions don't entangle them.

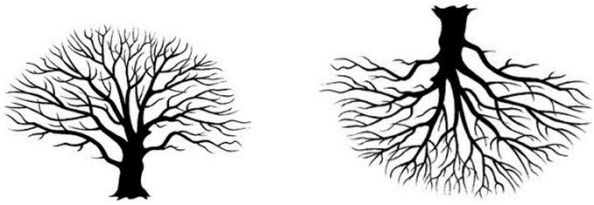
> यत्रोपरमते चित्तं निरुद्धं योगसेवया |
> यत्र चैवात्मनात्मानं पश्यन्नात्मनि तुष्यति || BG 6.20||
> *yatroparamate cittaṃ niruddhaṃ yoga-sevayā*
> *yatra caivātmanātmānaṃ paśyann ātmani tuṣyati*
> When the restrained mind becomes still by the practice of Yoga, then the yogi is able to behold the Self through the purified mind, and rejoices in the inner joy.

> सर्वभूतस्थमात्मानं सर्वभूतानि चात्मनि |
> ईक्षते योगयुक्तात्मा सर्वत्र समदर्शन: || BG 6.29||
> *sarva-bhūtastham ātmānaṃ sarva-bhūtāni cātmani*
> *īkṣate yoga-yuktātmā sarvatra sama-darśanaḥ*
>
> Seeing the Self within all living beings, and all beings within the Self, he who sees himself united with the Self, sees all with an equal vision.

> अनन्याश्चिन्तयन्तो मां ये जना: पर्युपासते |
> तेषां नित्याभियुक्तानां योगक्षेमं वहाम्यहम् || BG 9.22||
> *ananyāś cintayanto māṁ ye janāḥ paryupāsate*
> *teṣāṃ nityābhiyuktānāṃ yoga-kṣemaṃ vahāmyaham*
>
> Those who always think of me and are engagedin full devotion. To those absorbed in me, I provide a refuge in yoga.

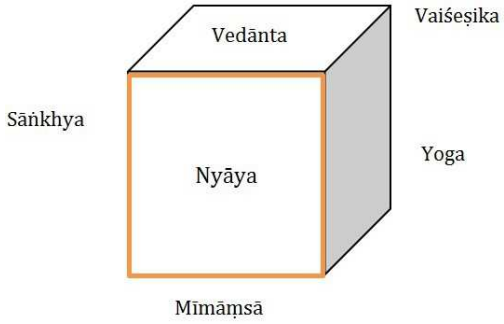
According to the Vedic view, reality, which is unitary at the transcendental level, is projected into experience which is characterized by duality and paradox. We thus have duality associated with body and consciousness, being and becoming, greed and altruism, fate and freedom. The gods bridge such duality in the field of imagination and also collectively in society: Viṣṇu is the deity of moral law, whereas Śiva is Universal Consciousness. Conversely,

the projection into processes of time and change is through the agency of the Goddess. Consciousness (*puruṣa*) and Nature (*prakṛti*) are opposite sides of the same coin.



(a) upright tree and (b) inverted tree

Two views on how consciousness arises: (a) Materialism, where cognitive capacities arise out of the body; (b)Vedic, reality is like an inverted tree where the root of the tree is Universal consciousness and the branches are various embodiments.



The magic cube of 6 darśanas: Mīmāṃsā is floor, Sāṅkhya is left side, Nyāya front side, Yoga right side, Vaiśeṣika back, Vedānta ceiling.

The Vedic disciplines of the darśanas sharpen the mind and reveal the paradoxes that lie at the end of logical thought.

KNOWING AND FORGETTING

In the consciousness-centered view of reality that the Vedas espouse, the seer is within us. But then why don't we know? What is the cause of our alienation and grief, and what is the path forward?

> सर्वस्य चाहं हृदि सन्निविष्टो|
> मत्त: स्मृतिर्ज्ञानमपोहनं च ॥BG 15.15 ॥
> *sarvasya cāhaṃ hṛdi saṃniviṣṭo*
> *mattaḥ smṛtirjñānamapohanaṃ ca*
>
> I am seated in everyone's heart; from me come remembrance, knowledge and forgetfulness.

We do not know because *apohana*, forgetting, is a part of our nature.

अधिभूतं क्षरो भावः पुरुषश्चाधिदैवतम् |
अधियज्ञोऽहमेवात्र देहे देहभृतां वर ||BG 8.4||
adhibhūtaṃ kṣharo bhāvaḥ puruṣaś cādhidaivatam
adhiyajño 'ham evātra dehe deha-bhṛitāṃ vara

Materiality (adhibhūta) is my perishable nature and am puruṣa or consciousness (adhidaiva); I alone am the transformation (adhiyajña) in this body.

The self is manifested both in the inner and the outer (and these connections are called bandhu), but forgetting of real meaning and wishing to see things in materiality alone (apohana) leads to paradox (parokṣa). By transformations within (yajña), it becomes possible to open the inner eye and get to know one's true self.

AT THE THRESHOLD

Yoga is everywhere and it is practiced by hundreds of millions for health and wellness. The *āsanas* and *prāṇāyāma* have proven medical benefits [6], and now increasing number of practitioners are graduating to practices that control the mind with even greater promise for health and strengthening of the immune system. Given Yoga's general popularity, one hopes that the medical establishment will integrate its therapy much more comprehensively in both the training of doctors and treatment of patients.

The next phase in the spread of Yoga will be the use of its epistemology in the design of the curriculum in schools and colleges and the teaching of its methods, philosophy, and history.

NOTES

1. For more material on such phenomena, see any book on neuroscience. For popular accounts, see Kak (2000) or Sacks (1994).
2. See Kak (2019) for an introduction to the Veda.
3. The word *sva-tava* became *xwa-taw* in Avestan and Khotanese and from that it takes us to Persian *khoda* (Sanskrit *sv-* becomes Persian *kh-* as in the word for Sun changing from *svara* to *khar*) and then the German "Gott".
4. Kak (2016); for further connections with epistemology, see Kak (2021) and Kak (2022).
5. See, for example, Kak (1993), Dirks (2001) and Fárek (2017).
6. There is huge clinical literature on the benefits of Yoga. See, for example, Link (2017), McCall (2007), Stephens (2017).

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3

Nanā Devi Ambā and the Zodiac*

INTRODUCTION

Goddess Nanā was the main goddess of the Kushan emperors in Bactria and Northwest India and also the presiding deity in temples and cities across Mesopotamia, Iran, and Central Asia from third millennium BCE onwards. There is controversy about the origins of her worship, in which she takes many forms: Western scholars generally believe that her cult emerged in Mesopotamia and traveled eastward from there, but the Ṛgveda also mentions her name and the Devīsūkta hymn of the Ṛgveda includes qualities like that of the Mesopotamian Nanā.

There is evidence of the westward movement from India of the worship of the goddess both prior to the Kushans and thereafter, and this indubitable westward movement complicates the story of Nanā's origins. There is also the question of the astral aspect of the worship of the goddess, which is the union of the zodiac Leo sign with Virgo, and present evidence from the Ṛgveda that supports this conception.

Scholars have argued that the study of goddess worship can contribute to a better understanding of the ancients' perception of the cosmos and the role of astronomy in its development.[1] Specifically, the investigation of the orientations of the altar and temples of Artemis Orthia in Sparta indicate that in addition to sunrise the directivity to the Pleiades and Orion may have been a part of the cult. We begin with this motivation to look at the origins of the Mesopotamian goddess Nanā who later assimilated Artemis in the Hellenized West Asia.

The goddess with the lion is an image that extends across time for more than 6,000 years and across a wide geographic region as far as Minoan Crete to the west, Anatolia (Turkey) to the north, Egypt, Mesopotamia (Sumer, Babylon, modern Iraq), and India. Included in the Mesopotamian pantheon is the Sumerian Inana who later became Ištar in Akkad; she was the preeminent goddess of love and war. In her astral aspect, Inana/Ištar is the planet Venus, the morning and the evening star; she is also shown with a lion and the Sun (Figure 1). In Sumerian history, an enactment of a sacred marriage ceremony between Inana (represented by her high priestess) and Dumuzi (represented by the ruler) was celebrated during the New Year's festival to ensure prosperity and abundance.[2]

In a famous Sumero-Akkadian hymn, the Mesopotamian goddess Nanā proclaims how she has different forms in different cities and temples, that range from her manifestation as Inana, daughter of Sin and Ur, sister of Šamaš, slave in Uruk, lady with

* Academia.edu (2021)

heavy breasts in Daduni, and one with a beard in Babylon; and she is the queen of Ur.[3] She was elevated to the supreme goddess in another Old Babylonian hymn and elsewhere she combined the qualities of Inana with that of Ištar. In an Old Babylonian hymn, Nanā's father An, is said to have elevated her to the position of a supreme goddess.

Figure 1. Goddess Inana/ Ištar on an Akkadian seal
(notice her weapons and the lion at her foot)

The Mesopotamian story, with its many goddesses that are sometimes equated to one single goddess, is widely known. The worship of Nanā together with the Greek Artemis is seen later in the Hellenized world and Iran. In Susa, the worship of Artemis-Nanā continued until the seventh century. Nanā's Iranian counterpart was the Avestan Spenta Armaiti, also the Vedic Aramati, who was seen later as the daughter of the sky god Ahura.[4] Scholars are generally agreed that the worship of Nanā spread eastward from Mesopotamia to Bactria and Transoxiana where the goddess came to occupy a leading position in the pantheon.[5]

For related goddesses in lands further off, note Nane (Armenian: Նանե, *Nanė*) is an Armenian mother goddess who is also the goddess of war and wisdom. She was depicted as a young beautiful woman dressed as warrior, with spear and shield in hand. This is quite like the Greek Athena, with whom she identified in the Hellenic period. Babylonian Nanā and Sumerian Nanai were most likely the same goddess.

An attempt was made by Mukherjee[6] to see connections between Nanā and Durgā, the Indian goddess with the lion, and this has been further added to in a recent study[7], but the focus of these studies were the Kushan and pre-Kushan periods. In the present paper, we wish to examine the parallels between the Vedic goddess who proclaims her powers boldly in the Devīsūkta and that of the Mesopotamian Nanā/Inana who is also supposed to be all powerful and source of all knowledge.

This article has two objectives. First, it considers the astral aspect of the worship of

Durgā, which is the union of the zodiac Leo sign with Virgo, and present evidence from the Ṛgveda that supports this conception; this evidence is consistent with the statement in Ṛgveda 1.164 that divides the ecliptic into twelve parts. Second, it shows that the conception of Goddess Nanā of Bactria owed not only to Goddess Nanā/Inana of Babylonia as has generally been accepted but also to Goddess Nanā/Durgā of India and for this we present evidence of transmission of various cultural concepts from India to Central Asia.

THE VEDIC GODDESS

It is not widely known that Nanā, which in Sanskrit stands for the goddess speech (Vāc), mother, daughter, brother's wife, also finds mention in the Ṛgveda, and this fact represents an unknown angle to the goddess story. We argue below that the identity of the name is more than a coincidence, and there are functions of the goddess described in the Ṛgveda that correspond to the powers of Nanā. The goddess in the Vedas has many names that include Ambikā or just Ambā (Mother), Aramati (Devotion), Durgā (Unassailability), Sarasvatī (Knowledge), Lakṣmī (Success), and many others that represent different roles of embodiment she plays in the world, and Nanā as Mother quite fits into it.

Ṛgveda 9.112.3, says *kāruraham tato bhiṣagupalaprakṣiṇī nanā* कारुरहं ततो भिषगुपलप्रक्षिणी नना, "A poet am I, my dad's a physician, Nanā scatters jewels." Literally, it means that Nanā does *upalaprakṣiṇī,* that is grinds with the millstones or scatters jewels ("upala" means both stone and jewels, and "prakṣ" means both grind and scatter*)*. Since the immediately preceding mention is of the poet, and father as physician, it is more likely that the goddess who dispenses fortune is meant. We propose that statement has an astronomical basis and by father (*bhiṣag*) is meant the nakṣatra Śatabhiṣaj which is opposite to the meeting of Maghā (मघा) and Pūrva Phālgunī (पूर्व फाल्गुनी), which correspond to Leo and Virgo, respectively.

The identification of nakṣatras as well as an implicit 12-way rāśi in RV 9.112 is not surprising since such a division is explicitly stated in RV 1.164.[8] It has been persuasively argued by Achar[9] that the nakṣatras are listed in the Ṛgveda; they are also listed in the Taittirīya Saṃhitā and in the Vedāṅga Jyotiṣa.[10]

The Śrī Sūkta gives several other names of the goddess including Ārdrā ("of the waters" in ŚS 13), and she is compared to the moon illumined by the sun. Indeed, it is the light (the illuminating self behind the observation) that makes her auspicious (ŚS 8). The Ārdrā reference is to creation emerging out of the womb of the primal waters.

Another hymn in the Ṛgveda 10.125 (Devīsūkta) has the goddess proclaim that she is the sovereign queen of all existence, the ultimate object of all worship, and she issues out forms to all the created worlds.

> *I go with the Rudras, with the Vasus, with the Ādityas and the Viśvedevas; I support both Mitra and Varuṇa, Indra and Agni, and the two Aśvins.* 1

I support the foe-destroying Tvaśṭṛ, Pūṣan and Bhaga; I bestow wealth upon the institutor of the rite offering the oblation - (who is) pouring forth the libation and deserving of careful protection. 2

I am the sovereign queen, the collector of treasures, all-knowing, the chief object of worship; the gods have put me in many places, abiding in manifold conditions, entering into numerous forms. 3

He who eats food (eats) through me; he who sees, who breathes, who hears what is spoken, does so through me; those who are ignorant of me, perish; listen all who can hear, I tell you that which is deserving of belief. 4

I myself declare this which is approved of by both gods and men; whomsoever I choose, I render him an exalted one, make him a rishi, make him brahman or make him highly intelligent. 5

I bend the bow for Rudra, to slay the tormenting, brahman-hating enemy. I wage war against men; I pervade heaven and earth. 6

I bring forth the departed ones upon the crown of (this Supreme Being); my genesis is from the waters from where I pervade through all beings and touch the heaven with my body. 7

I truly myself breathe forth like the wind, issuing out form to all the created worlds; beyond the heaven, beyond the world - so vast am I in my greatness. 8

Figure 2. Goddess Durgā panel (7th Century) at Mahābalipuram (photograph by the author)

This breathtaking hymn, of soaring imagination, should convince us that the Vedic rishis were quite clear in their understanding that the path of the goddess was the path of power. Of these goddesses, it is Durgā who rides a lion (Figure 2). She represents both the

free-wheeling Nature, which evolves by natural law (*ṛta*), as well as the control of it by higher agency. In the domain of human life, Nature is the complex of the instincts that is epitomized by the freedom of the mount. Yet, the Goddess assimilating the power of the spirit, quite like the *dṛṣṭi-sṛṣṭi* of Vedanta in which consciousness controls the physical world, commands the beast and make it do what she wants. The symbolism is thus informed by deep Vedic insights.[11]

The astral aspect of the worship of Durgā is the union of the zodiac Leo with Virgo. Now, after taking into account the precessional shifting of the zodiac, in the month of Bhādrapada, the Sun is in Leo, and in the month of Āśvin, when Durgā is worshipped, it enters Virgo (this conjunction of the Sun and the Lion is also seen in the seal of Figure 1). The first nine nights of Āśvin are *Navarātri*, the great festival of the worship of the goddess. The day of worship of Durgā is Friday, the day of the planet Venus, which shows its continuity with Nanā of West Asia.

INDIA AND CENTRAL ASIA

The representation of Nanā in Central Asia is taken to be a syncretism of the conceptions from the west and the east. This shouldn't be surprising, given that the Mitanni of West Asia worshiped Vedic divinities[12] and there is considerable evidence that Central Asia was the conduit through which many cultural elements of India diffused to the Slavic world.[13] Indeed, it is logical to presume that the westward movement from India goes back to the second millennium BCE and earlier.

Here's a brief summary of India's knowledge of this region which in the Mahābhārata is called Uttarakuru and Uttaramadra, which provides a context for how Indian ideas could have reached there. The Aitareya Brāhmaṇa (6th century BCE according to Keith[14] but perhaps older), says (in 8.14) that the kings of Uttarakuru and Uttaramadra, in regions beyond the Himalayas in the north, had Vedic consecration.

We know that the regions of Kuru and Madra were roughly in the Ganga-Yamuna doab and West Punjab, respectively. One may then infer that during the period of the Aitareya Brāhmaṇa, Uttarakuru was the Tarim Basin and Uttaramadra the region beyond Bactria (Bāhlīka).

Megasthenes and Strabo both mention the Uttarakuru as a land associated with the Indians. Ptolemy (100 CE) spells Uttarakuru as *Ottorokorrhas* and describes it to be in the mountains in Central Asia, but erroneously locates it further to the east. Since the Greeks don't mention Uttaramadra, it appears that by the time of Classical Greece the entire region right up to Caspian Sea was called Uttarakuru (with the name Uttaramadra absorbed into it). The Mahābhārata and the Dīgha Nikāya describe some social customs of Uttarakuru, and these are similar to the descriptions by the Greeks.

India's knowledge of the northern latitudes of the lands of Uttarakuru is in Vālmīki Rāmāyaṇa (Crit. Ed. 42.57) in which Sugrīva tells his followers: "Don't venture beyond Uttara Kuru. The region beyond, where unending night broods, is unknown to us." This indicates knowledge of the unending night of the Siberian winter.

The people that lived in Uttarakuru and Uttaramadra were the Śaka (Greek: Σάκαι, *Sákai*) (Shaka, Scythians) and this is the name in Sanskrit for the nomads speaking various Aryan languages. According to Herodotus in his *Histories*, the Achaemenid Empire called all of Scythians as "Saka". They most definitely were composed of many groups (just as the term Indian means different languages and ethnicities) and they were to be found from Tarim Basin to the Danube in Europe. An inscription dated to the reign of Xerxes I (r. 486–465 BC) has them coupled with the Dahae (Dāsa) people of Central Asia.

For more specificity within the Śaka, the Tocharians lived in the Tarim Basin to the northeast of Kashmir. They spoke an Indo-European language and they are believed to be the "Yuezhi" (Chinese 月氏) of Chinese texts. The region of the Tocharians constituted the Buddhist missionary highway from India to China, and over 7000 texts in Indian-style oblong poṭhī leaves of Buddhist material dating from 400 to 1200 CE have been found there. Linguists have determined that the language of the Śaka in the Kingdom of Khotan in the Tarim Basin has many borrowings from the Middle Indo-Aryan Prakrit. Elements of Tocharian culture survived until the 7th century, but they were later absorbed by Turkic people and have become the modern-day Uyghur ethnic group, and the word Uyghur itself may be derived from Uttarakuru.

Two thousand years ago, we find the Kushans in Bactria and it is believed they had moved there from the Tarim Basin. The genealogy of the Kushans until the time of Emperor Kanishka is provided by the Rabatak inscription, made on a rock in the Bactrian language, which was discovered in 1993 in Afghanistan. In this inscription, Kanishka calls the language of the Kushans to be Arya. The Hunas (or the Hephthalites or Ebodalo ηβοδαλο) who lived in the same region and became prominent sometime later also spoke an Arya language.[15]

Herodotus (1.201, 1.204.1.) says that one tribe of the Śaka was Massagetae and it was settled somewhere in the great plains to the east of the Caspian Sea. Ptolemy's Geography 6.10.2 sees them much further south near Kashmir. The Sanskrit form of Massagetae appears to be Mahājaṭa, and related tribes are the Getae (Jat, Skt.: Jaṭa) and Thyssagetae (Skt. Tiṣyajaṭa). The 9th century Frankish Benedictine monk, Rabanus Maurus, stated: "The Massagetae are in origin from the tribe of the Scythians, and are called Massagetae, as if heavy, that is, strong Getae."[16]

During Alexander's campaign in western India in 329/28 BCE there were rebellions of the Sogdians, Bactrians, and Massagetae. From this it may be concluded that they were to the south of the Bactrians and thus situated squarely in Punjab. They are also seen as neighbors of the Aśvakas, which is apparently the early form of the name Avagānā for the Afghans used by the Indian astronomer Varāhamihira. When Arabs entered Sindh in the seventh century, the Jats were the chief tribe they met and they called them Zatt. This shows that the Jats were spread all the way from Sindh to Afghanistan and beyond.

The most famous Massagetae of ancient history is Queen Tomyris (with Sanskrit

cognate Tahmirih, a daughter of Dakṣa). She defeated and killed Emperor Cyrus in 530 BCE. Herodotus describes the great victory of Tomyris thus (Herodotus, 2018). In Europe, the Getae were considered similar or equivalent to Thracians, who, not surprisingly, worshiped Dionysus (who many see as the Greek name for Śiva) and the goddess Bendis (= Artemis = Nanā) who is seen as equivalent to Durgā.

NANĀ IN SOGDIA AND IRAN

For a specific area in Central Asia, we consider Sogdia's religious history for evidence of Indian influence.[17,18] Until the end of the first millennium CE, the religions of the region included the dualistic Zurvanite Zoroastrianism and Manichaeism along with Buddhism, Hinduism, and Nestorian Christianity. The currency of Hinduism is seen in the worship of Brahmā, Indra, Mahādeva (Śiva), Nārāyaṇa and Vaiśravaṇa (Kubera).

It is remarkable that Sogdian Buddhist and Manichaean texts mimic the Vedic trinity and use Hindu symbols. Zurvan (who symbolizes Time, Avestan *zruuan* from Sanskrit *śravaṇa)* is depicted in the form of Brahmā, Adbag (Ādibhaga, the first god) is in the form of Indra (Śakra), and Veśparkar (Vāyu) in the form of Śiva (Mahādeva). This use of Hindu symbols by competing religions shows the influence of Hinduism in Central Asia during that period. Since the Sogdian state was not strong, it became possible for the folk religion to gain expression in uniquely new ways.

Hindu images indicate that the religion was popular in the general population, even when the ruling class patronized others. The worship of the goddess is a central aspect of lived Hinduism, because to reach the heart of awareness, one's true self, one must use the "shadows" of it in the inner sky of our mind. The false associations (represented by the buffalo demon) are destroyed by the power and light of Durgā, and so the goddess symbolizes the path of active search for knowledge that transcends sectarian worship.

Anāhitā is the Old Persian form of the name of a goddess who was earlier known as Aredvi Sura (Ārdrāvī Śūrā), of the waters and mighty (Boyce, 2001).[19] Anāhitā, immaculate, is an appellation quite identical in meaning to Nirañjanā. Goddess Anāhitā remained popular in Iran until her worship was suppressed by an iconoclastic movement under the Sasanians (who ruled 224–651 CE). This indicates the influence of Devī Ambā in lands further south and southwest of Sogdia.

In the very first line of the Rabatak Inscription, the Kushan emperor Kanishka proclaims about himself: "the great deliverer, the righteous, the just, the autocrat, the god, worthy of worship, who has obtained the kingship from Nanā and from all the gods, who has laid down the year one as the gods pleased."[20] Nanā is attested by name on a coin of Sapadbizes, a first-century BCE king of Bactria. She also appears on the coins and seals of the Kushans.

A four-armed Goddess Nanā with lion as her *vāhana* (mount) is seen painted in a palace in Panjikent near Samarkand.[21] Indeed, the complete Sogdian name of Nanā in the Sogdian script rendered in modern Latinized form is nnδβ'mbn nənə-δβāmbən: Nanā-

debi-amban or Nanā-Devī-Ambā, ननादेवीअम्बा, Nanā– Goddess–Mother.

Figure 3. Four-armed Goddess Nanā from Panjikent in Sogdia, holding Sun and Moon (Seventh Century, after Whitfield[22])

Since Ambā (Universal Mother) is the original name and Durgā just an appellation, it may be concluded that Nanā Devī Ambā is indeed the same as Durgā.

It is significant that Durgā is called Nani in shrines as far as Balochistan and Naina Devi in Himachal Pradesh. The latter variant means "Goddess with [Beautiful] eyes" which stresses the "command from seeing aspect" of the deeper intuition. Goddess Mīnākṣī, मीनाक्षी, "fish-eyed one", also stresses the same insight.

Figure 4. Durgā killing the buffalo demon (early 18th century, Guler style)

Sogdian is an Eastern Iranian language. However, the Eastern branch has much overlap with Indo-Aryan[23] that the academic classification obscures.[24] To see this, note that

according to the standard view, Avestan is literally identical with Sanskrit, as in the Sanskritized lines for Yasna 10.6:[25]

Avestan: tëm amavañtëm yazatëm, súrëm dámóhu sëvištëm, miθrëm yazái zaoθrábyó
Sanskrit: tam ámavantam yajatám, šúram dhámasu šávistam, mitrám yajái hótrábhyah

From this perspective, Avestan should be Indo-Aryan, or Indo-Iranian should be taken to be the same as Vedic Sanskrit, with a division in time into various Prakrits that include Indian and Iranian languages. This allows one to see the affinity of Śaka languages of Central Asia are Prakrit languages and we do know that Gāndhārī of the Tarim Basin is a Prakrit.[26] We also know that Śaka languages have features in common with the Dardic languages of the Indo-Aryan branch.[27] In addition, the Śaka languages have other assimilated aspects of Sanskrit that have led to the invention of the linguistic category of Buddhist Hybrid Sanskrit (BHS).

These goddesses also went east from India. For example, Kishijoten and Benzaiten are the names of Lakṣmī and Sarasvatī in Japan. At the other end, the Roma have clung to the worship of Durgā in the form of Kālī, personification of Time, as Saint Sara.[28]

CONCLUSIONS

This paper pointed out that Ṛgveda 9.112.3 alludes to Nanā in astronomical terms with her husband identified as the nakṣatra Śatabhiṣaj which is opposite on the ecliptic to the meeting of Maghā (मघा) and Pūrva Phālgunī (पूर्व फाल्गुनी), and this corresponds to Leo and Virgo, associated with the worship of Durgā. This is consistent with the division of the ecliptic in twelve parts as in Ṛgveda 1.164 supporting the view that Zodiacal signs have a much older basis than the popular theory that they emerged in Babylonia in the first half of the first millennium BCE.

Goddess Nanā was the presiding deity in temples and cities across Mesopotamia, Iran, and Central Asia from third millennium BCE onwards, and she was the main goddess of the Kushan emperors. Although the scholarly opinion is that her worship emerged in Mesopotamia and traveled eastward from there to Bactria, we provided evidence for a westward migration out of India of the worship of a similarly named goddess. This claim should not be surprising since Bactria (Bāhlīka) was a borderland of the Vedic world in its earliest phase and during the Mitanni period Vedic ideas extended all the way to West Asia.

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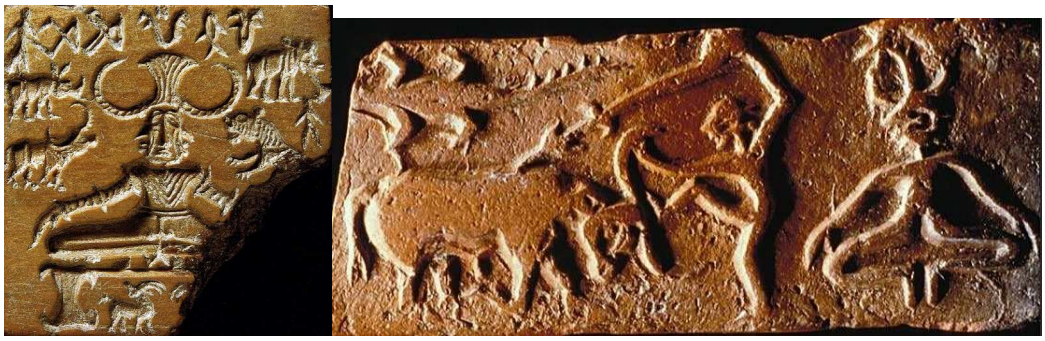
4

Early Many-Faced Viṣṇu and Śiva Images*

INTRODUCTION

The Harappan Era of Indian culture has representations of divinities. These include a male figure seated in a yogic pose, surrounded by animals, that is reminiscent of Śiva-Paśupati (dated to 2350-2000 BCE), as well as Goddesses and other heroic figures. This essay does not cover this early phase of Indian culture because of contested interpretations; rather, it presents images from a later period for which corresponding textual evidence exists.



Harappan Era images of divinities

There are references to images in the Ṛgveda, such as 4.24.10: क इ॒मं द॒शभि॒र्ममेन्द्रं॑ क्रीणाति धे॒नुभिः॑ *Who will buy this my Indra for ten cows,* and 8.1.5 म॒हे च॒न त्वामं॑द्रिव॒ः परा॑ शु॒ल्काय॑ देयाम् *O Indra, I shall not sell you for a might price*.

There are some who don't accept these obvious meanings due to the belief that images emerged late in India. This belief hangs on the misunderstanding of important elements of Vedic society,[1] and the false notion of India advanced by European authors to suit nineteenth century's colonial project which, sadly, persists.[2]

Let us consider the great Agnicayana ritual of the Vedic period that is generally assigned to late 2nd millennium BCE but could be much older since fire altars have been discovered at Harappan sites and the *astronomical dates in the Vedic texts overlap with the Harappan period*.[3]The golden image of Puruṣa was a part this ritual in which a five-layered altar in the shape of a falcon was made of a total of 1,000 bricks.[4]

According to Śatapatha Brāhmaṇa 7.4.1, within the hollow brick in the navel of this altar, a lotus-leaf is placed upon which is then placed a gold rukma (a disk, with 21 hangings), which symbolizes the sun. The golden puruṣa (representing Prajāpati the Creator) is laid on

* Academia.edu (2021)

the back with the head towards the east on top the rukma. Thus the image of the golden puruṣa goes back to the earliest phase of the Vedic period and we see that it includes components that are normally assigned to the "post-Vedic" period.

The fire in the altar, Agni, represents speech in its various form and in its supreme manifestation it is the transcendent Puruṣa.[5] Agni has three forms: fire, lightning, and the Sun, and so is shown with three heads sometimes. The meaning of speech here is two-fold: first, it is the symbol of consciousness and second, it is the uttered mantras that are a means to uncover the Puruṣa within, hidden by habit and chain of karma.

But just as fire has two aspects: heat that can scorch and burn, and light that helps one see, consciousness has both a dangerous and an auspicious aspect. Light cannot be produced without heat, and one cannot in one's practice separate the two. The interplay of heat and light is one of the many complementarities that constitute *samudra manthana*, the churning of the ocean (the asuras represent materiality and the devas represent the senses). Indeed, some heat is essential to wake one up from conventions that alienate one from one's own self.

In the Ṛgveda, Agni is identified with Rudra and this is reiterated in the Nirukta. According to Vājasaneyi Saṃhitā 16.2, Agni has two forms, the fierce Rudra and the auspicious Śiva. During the building of the altar, Agni appears in its raudra manner, and to propitiate it the Śatarudriya *homa* is performed.[6] This propitiation of Agni-Rudra is done literally by a stream of water that drops out of an earthen pot hung over the liṅga. In one of the constructions of Nāciketa Agni, 21 golden bricks are placed one top of another to form the liṅga (Taittirīya Brāhmaṇa 3.1.1.6).

Two representations of Agni

In the Vaiṣṇava tradition, the visualized golden puruṣa is Viṣṇu-Nārāyaṇa who emerges from the navel of the lotus on the altar that represents the waters, and for this reason is also called Padmanābha. The golden disk upon the lotus is then the sudarśana cakra of Viṣṇu. The Vaiṣṇava view of divinity is the universal one *outside-in*, whereas the Śaiva view is *inside-out*. They are complementary.

Yāska (seventh or sixth century BCE) has a discussion of the representation of divinities in human-like forms. Pāṇini (fifth century BCE), speaks of utsava mūrtis,[7] the images that were taken around in a procession. In Aṣṭādhyāyī 5.3.99, *jīvikārthe cāpaṇye*, the injunction is against selling of certain kinds of images. The images that could be sold had the suffix *–ka* attached to the name, as in *Śivaka* or *Skandaka*. Patañjali's Mahābhāṣya (140 BCE) mentions Śiva-bhāgavatas as those who worship Śiva as bhagavān, and in 5.3.99, he mentions the images of Śiva and Skanda, and in 6.3.26, Śiva with Vaiśravaṇa. It is clear that temples to Dhanapati, Rāma, Kṛṣṇa, Śiva, Skanda, Vaiśravaṇa, Vāsudeva, Keśava, and Viṣṇu existed. The Gṛhyasūtras mentions temples of the gods by *devagṛha, devāgāra, devakula, devāyatana*, and so on.

VIṢṆU, ŚIVA AND VIŚVA

To understand the conception behind the images, one needs to go to the very heart of knowing. Our experience of reality is within the frame of space, time, and consciousness. The universe interpenetrated by divinity is Viṣṇu (the one who penetrates all), and space and time are intertwined because one can sense space only within the matrix of change. The finality that time represents is Death; it is the dual to life, i.e. Yama, but it is also experienced as vibration, as hearing or perception of change (Śravaṇa). As the foundation of life and reality, time is the Goddess (Devī), or more explicitly Kālī. Consciousness transcends the material self and it is Rudra-Śiva, Īśa or Īśvara.[8] Another way to look at it is through the five faces of Śiva: Sadyojāta, Aghora, Tatpuruṣa, Vāmadeva and Īśāna.[9] Sadyojāta represents the beginning of the movement of consciousness; Aghora is another name for Rudra (another is Bhairava); Tatpuruṣa is the normal state where consciousness remains hidden, Vāmadeva is the preserving side that is sometimes represented by Pārvatī; and Īśāna is the aspect that bestows grace.

The one undivided reality is projected in space, time, and consciousness, and the three are often seen in pairs as Harihara (Viṣṇu and Śiva), Śiva-Vaiśravaṇa as dual, and Ardhanārīśvara (Śiva and Pārvatī).

Śravaṇa as Time became Zurvan in the Avesta. Both Śiva and Śravaṇa were represented as the axis of reality.

Everyone knows that Sarva – *All* – is the name for both Viṣṇu and Rudra-Śiva, but the fact that Viśva – the *Universe* – an epithet for Viṣṇu is also used for Śiva is less known.

This usage goes beyond the more commonly known Viśvanātha (lord of the universe), Mahādeva, Maheśa, Maheśvara, and Parameśvara. There is a deep philosophical insight behind this name for we apprehend reality in our consciousness. At the deepest level our experience of reality as something consisting outside of us as well as consciousness of it are identical, so we can proclaim with Skanda Purāṇa, 1.8.20–21:

Viṣṇu is no one but Śiva, and he who is called Śiva is but identical with Viṣṇu.

The naming of the projections of the transcendent is done recursively. If Viṣṇu as

preserver and Rudra are a pair in the perspective from outside-in, Aghora (Bhairava) and Vāmadeva, and Paśu and Paśupati are so from inside-out. This explains Śiva's faces that capture phases of his continuous dance are shown in various combinations.[10] Agni and Śiva in the form of Bhairava are shown with flaming hair.

As embodiment of change and movement, Śiva has contradictory aspects. He is both a yogi who lives outside of society and a king who rules the world. He is a yogi and a renunciate as be seen in the matted locks of hair and the cobra that girds his torso, yet he wears a king's crown. He grants freedom from fear with the gesture of his upraised right hand.

The Upaniṣads speak of the three states of awareness: waking, dreaming, and deep sleep, together with the transcending fourth, or turīya. In the Māṇḍūkya Upaniṣad, the relationship between the object of experience and the experiencer appears in three-fold forms (त्रिधा भोगं) as – विश्व (Viśva) (gross), तैजस (Taijasa) (subtle) and प्राज्ञ (Prājña) (blissful). Our sense of the identity or distinctness of Viṣṇu and Śiva depends on the state of our consciousness.

The Mahābhārata has mention of four-headed Viṣṇu and the iconography is described in later Pañcarātra text. According to the Viṣṇudharmottara Purāṇa[11] 3.85.1-42, the four vyūhas of Nārāyaṇa, that is Vāsudeva, Saṅkarṣaṇa, Pradyumna, and Aniruddha can be depicted in human form. These are generally four different images fused together partially or fully. On the other hand, the image of Viṣṇu–Vaikuṇṭha is one image with eight (or four) arms, four heads, including a boar- and a lion-face.[12]

Each face of Śiva represents a different state of awareness since our cognitions are a dance between veiling and unveiling of consciousness, between reflexive behavior and freedom. On the other hand, the multiple faces of Viṣṇu are a representation of the descent (avataraṇa) in different world ages. Śiva's faces represent near simultaneity (as Siva's dance occurs recursively at all scales and times), whereas Viṣṇu's are across time, excepting in Viṣṇu's Viśvarūpa in which the whole universe is contained within him.

It appears that there was originally a three-faced Viṣṇu of the Mathura school of sculpture from Gupta time onwards, that may be called Vaikuṇṭha Trimūrti which was later enlarged with a fourth (*kāpila/raudra*) face on the back side that made it Vaikuṇṭha Caturmūrti.

Brahmā is shown with four heads, Viśvakarmā with five, Skanda with six, Gāyatrī with five, and so on, but that will not be considered any further. The representation of Maheśvara with 3 or 4 heads that became quite popular in Central Asia[13] and connections with the Old Slavic Religion[14] as is another story that we will not consider here.

Maheśvara became a divinity in Buddhism in Central Asia, China and Sogdia owing to its enduring popularity and there are examples of Buddhist worship of Śiva and Mahākāla.[15] This identity was recognized in other regions as well and the Buddha and Śiva are declared in *Bhinneka Tunggal Ika,* the national motto of Indonesia, as different yet one.

EARLY IMAGES

Saṅkarṣaṇa-Balarāma and Vāsudeva Kṛṣṇa with chattra (parasol) on a coin of Agathocles of Bactria circa 180 BCE

The Balarāma and Kṛṣṇa coins from 180 BCE and Caturvyūha: The left hand of Balarāma is *halabhṛt* (armed with plough) while the right hand holds the pestle (*musala*). Kṛṣṇa holds the cakra in the left hand and the śaṅkha in the right. We mention these here for their early date and also because they go into the Caturvyūha as emanations of Viṣṇu.

Caturvyūha emanations from Vasudeva (Mathura Museum)

The Mathura Museum has a second century CE Caturvyūha form with four-armed Vāsudeva holding a śaṅkha, his elder brother Balarāma emanating behind to his right under a serpent hood, his son Pradyumna to his left (this has been lost), and his grandson Aniruddha

on top.

Caturmūrti: The name Vaikuṇṭha for the form of Viṣṇu in the Viṣṇudharmottara Purāṇa[16] is four-faced (Caturmūrti), with the heads of a lion (right) and a boar (left), representing Viṣṇu's Narasiṃha and Varāha avatars, that flank the human head. This form is also called Parā-Vāsudeva. The fourth face in the rear is fierce (kāpila or raudra) and it faces the west. The Cakrapuruṣa to the left personifies the cakra, which was balanced by Gadādevi, the personification of the mace; Goddess Prithvi stands between Viṣṇu's legs.

Caturmūrti: Vaikuṇṭha Viṣṇu, Kashmir. The Met. Seventh century.

Vaikuṇṭha Caturmūrti was the tutelary deity of Kashmir during the Kārkoṭa and Utpala dynasties (625 – 1003 CE). This is the period of the flowering of the tradition of Kashmir Śaivism, showing the error in the sectarian understanding of the relationship between Śiva and Viṣṇu. The Utpala dynasty king Avantivarman (reigned 855-883) built in Avantipur temples of Avantīśvara and Avantisvāmī dedicated to Śiva and Viṣṇu, respectively. Abhinavagupta (c. 950 -1020), the great sage and philosopher, wrote not only numerous texts on Śaivism and Tantra, he also did a commentary on the Bhagavad Gītā.

The Lakshmana Temple of Khajuraho is dedicated to Vaikuṇṭha Caturmūrti. Though three-faced, an inscription declares that it should be considered four-faced for the rear face is

hidden.

Vaikuṇṭha Caturmūrti, 5th century, Mathura (left) and 9th century, Kashmir

MORE IMAGES

Kuṣāṇa coins (30 -350 CE) show Śiva four-armed, holding a trident, sometimes three-faced, sometimes with the bull Nandī; the legend on all these coins reads Oesho, which is a Bactrian spelling of Viśva or Īśa. Vima Kadphises (100 CE) declares that he is a worshiper of Śiva calling him Sarvalokeśvara (Lord of All)

Śiva with three-faces and Nandi, coin of Vasudeva I (190-230)

Śiva, with a second fierce human face of Rudra, and the head of a horned animal, on a coin of Vasudeva I is shown above.

Śiva as the Great God, Mahādeva, 8th century (Cleveland Museum of Art)

Śiva's face shows sovereignty: his feminine side, the left face, emanates as Pārvatī, and his right face is the fearsome Bhairava. His two sons, the elephant-headed Gaṇeśa and the warrior Skanda, are at his feet and his vehicle, the bull Nandi, shows calm determination in his eyes.

The Trimūrti: Brahmā, Śiva, Viṣṇu 8th–9th century, Kashmir. All three deities are in three-faced form: with Brahmā attended by haṃsa, Śiva by the calf Vṛṣabha, and Viṣṇu by his puruṣas, who personify his weapons (The Metropolitan Museum of Art)

CONCLUSIONS

This brief review began with the Vedic representations of divinity in the Ṛgveda and the Brāhmaṇas that speak of the golden Puruṣa in the great Agnicayana ritual. There are subtle reasons related to the nature of awareness that prompted the image of two-faced Agni (heat and light and the corresponding psychological states of suffering and grace).

Since Agni and Rudra are often seen to be identical, the two faces of Agni lead us to the understanding of the two, three, four and five faces of Śiva. These faces are encountered at all scales of reality almost simultaneously for time is represented by the dance of Śiva. The multiple faces of Viṣṇu are normally a different conception related to the avatars, yet in the Caturvyūha emanations they have a character that parallels that of Śiva.

NOTES

1. This was also responsible for the false notion that there were no proper houses due to the misidentification of temporary sacrifice shed for a regular house (Kak, 2005a).
2. Adluri and Bagchee (2014); see also Kak (2021b).
3. Lal (2002), Lal (2015). For astronomical dates see Kak (2016) and the references therein.
4. The altars were a representation of the Vedic conception of the cosmos in three layers of earth, atmosphere, and the heavens outside, and as prāṇa, and consciousness within the body. This conception and its multifaceted implications are described at length in Kak (2016).
5. Kak (2005b) has details some of which are reproduced in the paragraphs that follow.
6. Sivaramamurti (1976)
7. Agrawala (1953)
8. Gallo (2013), Bopearachchi (2016), Kak (2019)
9. Kramrisch (1981)
10. Kramrisch (1981)
11. Kramrisch (1928)
12. Gail (1983)
13. Gallo (2013)
14. Kak (2020), Kak (2021a)
15. Granoff (1979)
16. Kramrisch (1928)

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5
The Śiva Sūtra: Play of Consciousness*

rūpam rūpam pratirūpo babhūva
tadasya rūpam praticakṣanāya

He became the original form of every form
It is his form that is everywhere to be seen.
-Ṛgveda 6.47.18

Who are we? Why are we here? Are we free? If yes, what is the source of our freedom?

Science tells us we are machines, and looking through this lens our freedom is an illusion. In science there is no place for the spirit.

We are sure that there is something real to our inner world.

But ordinary science cannot reveal to us the nature of consciousness. This is because science can only tell us of the laws of objects which are expressed in language.[1]

With language we can only speak of objects.

But Consciousness is not an object.[2]

It is the searchlight with which we see objects in our inner or outer spaces or through the medium of the senses.

Consciousness is the perceiving subject.

Science, through its study of the brain in the search of the source of awareness can only reveal its limitations. It can show that the brain is like a machine but it cannot create a machine that is like the brain.

We face paradoxes; science has reached its limits.

That is where the 1200-year old Śiva Sūtra[3] comes in. Vasugupta saw the Sūtra in a dream. A great classic of the Trika Tantric tradition[4], it speaks to the mystery of consciousness in a manner that is consistent with the Vedas.

THE UNIVERSAL AND THE INDIVIDUAL

Our phenomenal knowledge can only be in terms of the associations of the outer world. But the associations in themselves need something to bind them together.

The binding is the *mātṛkā*, the womb of elementary sounds or phonemes associated with the resonances of the mind, which are components of the spoken language. It is the

* Brahmavidyā: The Adyar Library Bulletin, 85, 273-292, 2021

binding that makes it possible to understand words or symbols when they are strung together.

Since the mind is able to comprehend the whole, that is the sentence or larger expressions, the phonemes themselves cannot be used for comprehension. Since they lack the binding of the *mātṛkā*, computers cannot understand language.

Universal consciousness, as a unity, is Śiva or Bhairava. Śiva makes it possible for the material associations of the physical world to have meaning. The domain of the union of Śiva and the phenomenal world is a mystery that cannot be described in the aparā world of ordinary language.

The Ṛgveda speaks of two birds are sitting on a tree where one of them eats the sweet fruit and the other looks on without eating; one of the birds is the Universal Consciousness, the other the Individual Consciousness. In truth, there is only one bird; the other is just the image of the first as reflected in the fruit!

Although we cannot explain consciousness using science, we can intuitively grasp it. Our root consciousness — Śiva, *Prakāśa*, *Cit* — is what makes it possible to comprehend reality. It is the self-shining Light (*Prakāśa)* both creates the world and makes it understandable.

Consciousness has free will (*svātantrya*) and its reflection on itself is *vimarśa,* which represents the Goddess *Śakti, or* Creation. We can also say that the Light of Consciousness illuminates the associations in the mind by the power of the will or *icchā śakti.* The process of reflection is bliss (*ānanda*) and it is equivalent to *vimarśa* and *svātantrya*.

Awareness requires the idea of succession of cognitions or *saṃvit* (संवित्) that is "awareness-reality"; so another name for consciousness is *saṃvitti*. The awareness (*saṃvit)* occurs across the unfoldment of time (*samaya*) and, therefore, the mystery of Śiva can be resolved through meditation on *samaya*, where Śiva (*Prakāśa* or Light) and Śakti (*Vimarśa* or Knowledge) are one. Indeed, this forms the basis of a powerful spiritual practice called *Samayācāra* समयाचार.

CREATIVITY

Given these are universal principles, why isn't everyone a genius? Because the lamp of consciousness is obscured by coverings created by habits and saṃskāras, by education and culture. To obtain knowledge, one must remove these coverings of the mind. Sometimes, some light streams in spontaneously through a crack into the mind, and that can be a life-changing epiphany.

The creativity of the mind springs from direct light *pratibhā*, प्रतिभा, and although this intuition springs from outside the mind, it is eventually manifested in terms of a sequence, *krama*, associated with time and space. This sequence is represented in terms of conceptual schema or sacred images.

The Self (Śiva) is shown as a dot, *bindu*, in the center of artistic maṇḍalas, where the rest of the diagram denotes evolutes of Śaktī in expansion. But how does the process begin? In the individual it starts with desire, which can operate at many different levels, not just the

personal. In this unfolding, Śiva is addressed as *Kāmeśvara,* and together with Śaktī the conjoined form is *Kāmakalā*.

The individual who wishes to be creative must become a yogi, and move the focus away from the gross elements, that constitute the body, to pure sensations (*tanmātra*), then to the senses, and finally to the source of awareness. The yogi endeavors to reach the fourth state (*turīya*) beyond the ordinary states of waking, dreaming, and deep sleep; *turīya* is the real source of creativity.

There is a paradox in yogic practice that people pay little attention to. While its purpose is to unite one's personal self with universal consciousness, the union promised by yoga can only be achieved by disuniting oneself from the earlier self. It is the act (*kriya*) of removing traces (*vāsanā*) of discrete perceptions (*vikalpa*) born out of misconceptions (impurities, *mala*), which contract consciousness.

THE BOUND AND THE FREE

The cranial vault has no light: it's totally dark and there is no projection of images in the theatre of the mind. Yet the sensory information is bound (*paś* = to bind) in our perception, and we can say that the binding, *pāśa,* is the working of Śiva.

Remember that *paśu* (domesticated animals) are bound, *paśum aśvyam gavyam* (RV 5.61.5), and can be pulled by even a child. Humans are *paśu* for they too are led by simple stories like that of paradise or revolution or glory.

This explains why *paśya* is "to see" and Paśupati is another name of Śiva, for the binding of sense-impressions comes from consciousness, which also provides capacity for freedom.

Rudra-Śiva is called the 'best of physicians', *bheṣaja śiromaṇi* (शिरोमणि) or Vaidyanātha (RV 2.33.4). The eight names of Śiva given in Śivapurāṇa 1.20 are Hara (Destroyer), Maheśvara (Great Lord), Śambhu (Source of Bliss), Śūlapāṇi (carrier of Triśūla त्रिशूल), Pinākin (Archer), Śiva, Paśupati (Lord of beings), and Mahādeva (Great God).

Of these, the triśūla signifies the overarching connections between the three aspects of reality, that is body, mind, and consciousness, as well as the three guṇas. Śiva as Pinākin, the archer, sends out the flaming arrow that shines light in the dark chamber of the mind.

Śiva must also be seen as the complement to Viṣṇu, the pervader. If Viṣṇu is the universal order, then Śiva is dynamic change. Taken together, they are a unity called Harihara.

The great sage Yājñavalkya in the Bṛhadāraṇyaka Upaniṣad speaks of the eleven Rudras as different aspects of consciousness. These eleven find systematic representation in the categories of Kashmir Śaivism, by getting added to the 25 tattvas of Sāṅkhya for the total of 36. In our perspective the system is an emanation of the categories in the Vedas.

ON LANGUAGE

Let us return to the mind. It can be in states that do not provide clarity. But if mind is the problem, it is also the only instrument that one has. The practitioner must leverage the

perceptions of the mind, which are recounted in language, to transcend its limitations. Also since the mind is situated in the body, one must also address bodily states so as to be calm and focused.

Innate knowledge emerges from the mind, which is the *mantra*. It leads to the knowledge of the reality that lies beyond material associations.

Sound is made meaningful by strings of words. But what about the *meaning* of elementary sounds? This meaning is grasped as one opens the *crack* between the universal and the individual. The phonemes of the language are the womb, *mātṛkā, t*hat when joined with insight helps one to go beyond surface associations.

The individual is transformed into a state where light of knowledge shows new pathways.

Detachment from associations is the key to the knowledge of the Self or the Universal Being. Be an outsider. By separating the senses from the source of consciousness, it becomes possible to reach to the heart of the Self.

Could meditation on Consciousness have led the ṛṣis to insights that remain beyond the pale of our current understanding of the nature of reality?

The Śiva Sūtra deals with questions such as: How do the senses emerge in the emergence of the mind? Could there be more senses than we possess?

The stories of Śiva are a retelling of the astonishing insights of the science of consciousness. We can enjoy the dance of Śiva.

The Śiva Sūtra has three movements:

- *The first movement is about universal consciousness* (Śiva)
- *The second movement is about the emergence of innate knowledge* (Śakti)
- *The third movement is about self-transformation* (the individual)

These movements begin with the question of who we are.

We couldn't be just our life-history, our memories, and our desires and aspirations. A lot of that is the accident of our birth and our social experience.

When we strip off layer upon layer of the social self, we come to the essential being. The process of the stripping of the social self is painful but it is liberating.

It is this process that transforms the individual. It is this process that is the greatest sacrifice.

The Śiva Sūtra requires instruction by a master. Without that it is like talking of the fast moving current in the middle of a raging river from a distance, when the only way to experience the force of the current is to be in it.

The Śiva Sūtra

1. **Śāmbhavopāya, Śiva's View** or **the Path of Śiva**

1.1 Consciousness is the self. चैतन्यमात्मा॥१॥

1.2 (Ordinary) knowledge consists of associations. ज्ञानं बन्धः॥२॥

1.3 Emanations of the source are embodied activity. योनिवर्गः कलाशरीरम्॥३॥

1.4 The ground of knowledge is *mātṛkā* (the elemental sounds). ज्ञानाधिष्ठानं मातृका॥४॥

1.5 The upsurge (of consciousness) is Bhairava. उद्यमो भैरवः॥५॥

1.6 By union with the energy centers one withdraws from the universe. शक्तिचक्रसन्धाने विश्वसंहारः॥६॥

1.7 Even during waking, sleep, and deep sleep one can experience the fourth state (transcending ordinary consciousness). जाग्रत्स्वप्नसुषुप्तभेदे तुर्याभोगसम्भवः॥७॥

1.8 (Sensory) knowledge is obtained in the waking state. ज्ञानं जाग्रत्॥८॥

1.9 Dreaming is free ranging of thoughts. स्वप्नो विकल्पाः॥९॥

1.10 Deep sleep is *māyā*, the (state of) delusion. अविवेको मायासौषुप्तम्॥१०॥

1.11 The experiencer of the three states is the lord of the senses. त्रितयभोक्ता वीरेशः॥११॥

1.12 The stages of the union are astonishing, *vismaya*. विस्मयो योगभूमिकाः ॥१२॥

1.13 The power of the will is the playful Umā. इच्छाशक्तिरुमा कुमारी॥१३॥

1.14 The observed is embodied. दृश्यं शरीरम्॥१४॥

1.15 By fixing the mind on its core one can comprehend the perceivable and emptiness. हृदये चित्तसङ्घट्टाद्दृश्यस्वापदर्शनम्॥१५॥

1.16 Or by contemplating the pure principle one is free of the power that binds animal instincts. शुद्धतत्त्वसन्धानाद्वापशुशक्तिः॥१६॥

1.17 Right discernment is the knowledge of the self. वितर्क आत्मज्ञानम्॥१७॥

1.18 The bliss of the sight is the joy of *samādhi.* लोकानन्दः समाधिसुखम्॥१८॥

1.19 The body emerges when the energies unite. शक्तिसन्धाने शरीरोत्पत्तिः॥१९॥

1.20 Elements united and elements separated and the universe is assembled. भूतसन्धानभूतपृथक्त्वविश्वसङ्घट्टाः॥२०॥

1.21 Pure knowledge leads to a mastery of the wheel (of energies). शुद्धविद्योदयाच्चक्रेशत्वसिद्धिः॥२१॥

1.22 The great lake (of space-time) is experienced through the power of *mantra*. महाह्रदानुसन्धानान्मन्त्रवीर्यानुभवः॥२२॥

2 **Śāktopāya, the Process, the path of Śakti**

2.1 The mind is a measure, *mantra*. चित्तं मन्त्रः॥१॥

2.2 Effort leads to attainment. प्रयत्नः साधकः॥२॥

2.3 The secret of mantra is the being of the body of knowledge. विद्याशरीरसत्ता मन्त्ररहस्यम्॥३॥

2.4 The emergence of the mind in the womb is like a dream based on inferior knowledge. गर्भे चित्तविकासोऽविशिष्टविद्यास्वप्नः॥४॥

2.5 When the knowledge of one's self arises, one moves in the Sky of Consciousness, Śiva's state. विद्यासमुत्थाने स्वाभाविके खेचरी शिवावस्था॥५॥

2.6 The guru is the means. गुरुरुपायः॥६॥

2.7 The awakening of the wheel of *mātṛkā* (the elemental sounds). मातृकाचक्रसम्बोधः॥७॥

2.8 The body is the oblation. शरीरं हविः॥८॥

2.9 The food is knowledge. ज्ञानमन्नम्॥९॥

2.10 With the extinction of knowledge emerges the vision of emptiness. विद्यासंहारे तदुत्थस्वप्नदर्शनम्॥१०॥

3 **Āṇavopāya, the Individual's Means**

3.1 The mind is the self. आत्मा चित्तम्॥१॥

3.2 (Material) knowledge is bondage (association). ज्ञानं बन्धः॥२॥

3.3 Māyā is the lack of discernment of the principles of transformation (*kalā*). कलादीनां तत्त्वानामविवेको माया॥३॥

3.4 The transformation is stopped in the body. शरीरे संहारः कलानाम्॥४॥

3.5 The quieting of the vital channels, the mastery of the elements, the withdrawal from the elements, and the separation of the elements. नाडीसंहारभूतजयभूतकैवल्यभूतपृथक्त्वानि॥५॥

3.6 Perfection is through the veil of delusion. मोहावरणात्सिद्धिः॥६॥

3.7 Overcoming delusion while enjoying the world innate knowledge is obtained. मोहजयादनन्ताभोगात्सहजविद्याजयः॥७॥

3.8 Waking is the second ray (of consciousness). जाग्रद्द्वितीयकरः॥८॥

3.9 The self is the actor. नर्तक आत्मा॥९॥

3.10 The inner self is the stage. रङ्गोऽन्तरात्मा॥१०॥

3.11 The senses are the spectators. प्रेक्षकाणीन्द्रियाणि॥११॥

3.12 The pure state is achieved by the power of the intellect. धीवशात्सत्त्वसिद्धिः॥१२॥

3.13 Freedom (creativity) is achieved. सिद्धः स्वतन्त्रभावः॥१३॥

3.14 As here so elsewhere. यथा तत्र तथान्यत्र॥१४॥

3.15 Emission (of consciousness) is the way of nature and so what is not external is seen as external. विसर्गस्वाभाव्याद् अबहिः स्थितेस्तत्स्थितिः॥१५॥

3.16 Attention to the seed. बीजावधानम्॥१६॥

3.17 Seated one sinks effortlessly into the lake (of consciousness). आसनस्थः सुखं ह्रदे निमज्जति॥१७॥

3.18 The measure of consciousness fashions the world. स्वमात्रानिर्माणमापादयति॥१८॥

3.19 As (limited) knowledge is transcended, birth is transcended. विद्याविनाशे जन्मविनाशः॥१९॥

3.20 Māheśvarī and other mothers (sources) of beings reside in the "k" sound elements. कवर्गादिषु माहेश्वर्याद्याः पशुमातरः॥२०॥

3.21 The fourth (state of consciousness) should be used to oil the (other) three (states of consciousness). त्रिषु चतुर्थं तैलवदासेच्यम्॥२१॥

3.22 Absorbed (in his nature), one penetrates (the phonemes) with one's mind. मग्नः स्वचित्तेन प्रविशेत्॥२२॥

3.23 A balanced breathing leads to a balanced vision. प्राणसमाचारे समदर्शनम्॥२३॥

3.24 The lower plane arises in the center (of the phoneme). मध्येऽवरप्रसवः॥२४॥

3.25 What was destroyed rises again by the joining (*sandhāne*) of perceptions (*svapratyaya*) with the objects (*mātrā*) of experience. मात्रास्वप्रत्ययसन्धाने नष्टस्य पुनरुत्थानम्॥२५॥

3.26 He becomes like Śiva. शिवतुल्यो जायते॥२६॥

3.27 The activity of the body is the vow. शरीरवृत्तिर्व्रतम्॥२७॥

3.28 The recitation of the mantras is the discourse. कथा जपः॥२८॥

3.29 Self-knowledge is the gift. दानमात्मज्ञानम्॥२९॥

3.30 He who is established is the means and knowledge. योऽविपस्थो ज्ञाहेतुश्च॥३०॥

3.31 The universe is the aggregate of his powers. स्वशक्तिप्रचयोऽस्य विश्वम्॥३१॥

3.32 Persistence and absorption. स्थितिलयौ॥३२॥

3.33 Even when this (maintenance and dissolution) there is no break (*anirāsaḥ*, in awareness) due to the perceiving subjectivity. तत्प्रवृत्तावप्यनिरासः संवेत्तृभावात्॥३३॥

3.34 The feeling of pleasure and pain is external. सुखदुःखयोर्बहिर्मननम्॥३४॥

3.35 The one who is free of that is alone (with consciousness). तद्विमुक्तस्तु केवली॥३५॥

3.36 A mass of delusion the mind is subject to activity. मोहप्रतिसंहतस्तु कर्मात्मा॥३६॥

3.37 When separateness is gone, action can lead to creation. भेदतिरस्कारे सर्गान्तरकर्मत्वम्॥३७॥

3.38 The power to create is based on one's own experience. करणशक्तिः स्वतोऽनुभवात्॥३८॥

3.39 That which precedes the three (states of consciousness) vitalizes them. त्रिपदाद्यनुप्राणनम्॥३९॥

3.40 The same stability of mind (should permeate) the body, senses and external world. चित्तस्थितिवच्छरीरकरणबाह्येषु॥४०॥

3.41 Craving leads to the extroversion of the inner process. अभिलाषाद्बहिर्गतिः संवाह्यस्य॥४१॥

3.42 When established in pure awareness, (the craving) is destroyed and the (empirical) individual ceases to exist. तदारूढप्रमितेस्तत्क्षयाज्जीवसङ्क्षयः॥४२॥

3.43 Although cloaked in the elements that are not free, like the Lord, one is supreme. भूतकञ्चुकी तदा विमुक्तो भूयः पतिसमः परः॥४३॥

3.44 The link with the vital breath is natural. नैसर्गिकः प्राणसम्बन्धः॥४४॥

3.45 Concentrating on the center within the nose, what use are the left and the right channels or *suṣumnā*? नासिकान्तर्मध्यसंयमात् किमत्र सव्यापसव्यसौषुम्नेषु॥४५॥

3.46 May (the individual) merge (in the Lord) once again. भूयः स्यात्प्रतिमीलनम्॥४६॥

ॐ तत् सत्

NOTES

1. For example, in Kak, 2004.
2. For example, Kak, 2008-2009.
3. For translations of the Śiva Sūtra, see example, Singh, 1979 and Lakshmanjoo, 2015.
4. Various commentaries in the Trika tradition of Kashmir Śaivism include Chatterji, 1914; Dyczkowski, 1987; Singh, 1988. Bhāskara's Vārttika is in Vasugupta, 1992.

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6
The Buddha and the Veda*

INTRODUCTION

The layperson believes that whereas the Veda accepts the idea of the ātman (translated into English as "Self"), which is both immanent and transcendent, Buddhism does not. Indeed, in the popular imagination the Buddha promoted the doctrine of anātman or *anattā*, and he took the ground stuff of reality to be nothing, what came to be called śūnyatā or emptiness. Generally speaking, the recognition of the three doctrines of anatta, the absence of self, *anicca* (Skt. *anitya*, impermanence), and *dukkha* (suffering) as three characteristics of all existence (tri-lakṣaṇa), constitute "right understanding" in Buddhism.

In reality, early Buddhist texts do discuss ātman as in Dīgha Nikāya, Samyutta Nikāya, Vinaya, Majjhima Nikāya and Aṅguttara Nikāya. But for certain historical reasons, anattā became a bedrock doctrine of Buddhism. Nagarjuna (~200 CE), explicitly rejected ātman (self, soul), claiming in Mūlamadhyamakakārikā that "Buddha taught the doctrine of no-self."

The Self/No-self dichotomy means that the philosophical foundations of Hinduism and Buddhism are different. In Hinduism, consciousness (ātman) is primary and at the analytical level it is different from matter. In Buddhism, on the other hand, consciousness is a phenomenon that emerges on the ground of the body although it survives in the chain of influences it engenders. As an aside, both these doctrines are under consideration in modern science's quest to define consciousness.[1]

The Aggi-Vacchagotta Sutta, presents an exchange between the Buddha and a wandering ascetic named Śreṇika Vatsagotra (Pali: Senika Vacchagotta). The Buddha has taught there is rebirth but anātman, or no eternal Self. Śreṇika disagrees and asks the Buddha many questions, which the Buddha refuses to answer, calling his questions as indeterminate, indicating that any further response to the questions would entangle him in indefensible positions of Śāśvatavāda (eternalism) or Ucchedavāda (annihilationism). The Buddha uses the metaphor of Agni, stating that just like a fire when extinguished no longer exists, in the same way all *skandha* (aggregates) that constitute a person are extinguished upon death.

However, in another reference to the story in the Mahāyāna Mahāparinirvāṇa-sūtra[2] (MPNS) (महापरिनिर्वाणसूत्र), Śreṇika counters by comparing the physical body to a house whose owner is the eternal Self (ātman) who is outside when the fire burns it down.

Therefore, it will surprise many that this dichotomy of ātman versus anātman was declared false by the Buddha on his last day of life. He said:

> *The Self (ātman) is reality (tattva), the Self is permanent (nitya), the Self is virtue (guṇa), the Self is eternal (śāśvatā), the Self is stable (dhruva), and the Self is auspiciousness (śiva).*

* Medium (2020); Academia.edu (2021)

Other adjectives used by the Buddha for the Self are "sovereign" (aiśvarya), "unchanging" (avipariṇāma), and "true" (satya).

These are precisely the "attributes" associated with the Self (ātman) in the Vedas.[3] The attribute aiśvarya implies agency and brings to mind Īśvara, or Śiva. Īśvara is the free mind who has access to "transcendental knowing" or lokkottara-jñāna, which explains how Śiva-Maheśvara was integrated into worship in many parts of the Buddhist world.[4]

Quite like the term āvaraṇa (covering) hiding the Self from the mind, the Buddha speaks of many kleśas (mental and moral afflictions) preventing one from seeing the Self.

He suggests that the doctrine of No-self was advanced by him as an upāya to get his followers off from attachment to old ideas. But now they were attached to impermanence and emptiness, and so before he left the world he wished to reveal the secret doctrine of the Self.

He gave the Self or the ātman the name tathāgatagarbha, "thus-arrived-nature" (svabhāva of beings), or the buddhadhātu, "ground-state-of-illumination".[5] Just as the Veda speaks of a churning between avidyā (world as materiality) and vidyā (world as cognition) to obtain deep knowledge of the Self, the Buddha spoke of a churning between emptiness and non-emptiness.

The need for both avidyā and vidyā for knowledge is most beautifully expressed in the Īśa Upaniṣad as follows:

विद्यां चाविद्यां च यस्तद्वेदोभयँ सह |
अविद्यया मृत्युं तीर्त्वा विद्ययाऽमृतमश्नुते ॥ ११॥ ईशोपनिषत्

vidyāṃ cāvidyāṃ ca yastadvedobhayaṃ saha |
avidyayā mṛtyuṃ tīrtvā vidyayā'mṛtamaśnute ||

He who knows both vidyā and avidyā together,
crosses death through avidyā and through vidyā attains immortality.

It is significant that both elements are essential. Elsewhere, I have described intuition as the flight of the mind where the two wings are vidyā and avidyā.[6]

BUDDHA'S PARINIRVĀṆA

The circumstances under which Śākyamuni Buddha died and his last sermon are described in the Pali Mahāparinibbāna-suttanta and the Mahāyāna Mahāparinirvāṇa-sūtra (or just the Nirvāṇa Sūtra), the latter of which is a much more substantial text in which the Buddha goes into the very heart of the teachings that had been taught earlier by him.

We find the eighty-year old Buddha unwell. He and his entourage are in transit to the town of Kuśinagara in the land of the Mallas, where in the outskirts he lays down between a pair of sal trees, announcing his impending death. Hearing of this, throngs assemble. Amongst them is Cunda, an artisan from the town. He and others get down on their right knees and

address the Buddha entreating him to stay longer in this world. The Buddha reminds Cunda:[7]

All created things
Have impermanent nature
Having come into existence, they do not last
Tranquil extinction is bliss

But Cunda presents many arguments why the teaching of emptiness was not going to give them comfort and words like nirvāṇa — or even the non-nirvāṇa — of the Tathāgata seemed contradictory and difficult to understand. This prompts the Buddha to eventually reveal the secret doctrine of the ātman.

The MPNS is one of the most important scriptures in the Buddhist canon and in the fifth century two translations based on two different Sanskrit texts were produced, one by the famed traveler Faxian (418CE); and the other longer "Northern version" by Dharmakṣema in 422 CE. There is also a later Tibetan version (c 790CE).

The Buddha had used emptiness to help his disciples separate themselves from earlier attachments. He explains the supersession of the No-self doctrine by the Self doctrine with this parable:[7]

> Consider the story of mother whose infant son is ill. The physician gives her medicine for the boy with the instruction "After the child takes the medicine, do not give him your milk until he has fully digested the medicine." The mother smears a bitter-tasting substance on her breasts and tells her young child that the breasts have poison on them. Having heard this, the child pulls away from her when he is hungry. But after the medicine has been ingested, the mother washes her breasts and calls out to her son, "Come and I shall give you milk."

The Veda is the mother's milk that the Buddha did not allow his disciples to partake until they had purified themselves with the austere message of emptiness.

MAHĀPARINIRVĀṆA–SŪTRA IN CHINA

The translator of MPNS into Chinese was Dharmakṣema, who was a great celebrity of his times. He was born in Central India, and he received instruction from several teachers. This was the golden age of transmission of Buddhist texts to China, and to seek fame and fortune he went to Central Asia. At first he lived for several years in Dunhuang, busy with his work. But the city was conquered by the Northern Liang king Juqu Mengxun, who took Dharmakṣema with him to his capital Guzang in 421 and installed him as teacher, court advisor and translator of Sanskrit sutras.

By the mid-twenties, Juqu's overlord Tuoba Tao, the emperor of Wei, having heard of Dharmakṣema's fame wanted him, but Juqu resisted. To ease the pressure, Dharmakṣema was sent to India to acquire more texts. But when he returned after a couple of years, Tuoba Tao repeated his demand and threatened to invade Guzang.

But Juqu Mengxun did not want to give up Dharmakṣema, so as a way to solve this problem and appease his overlord Tuoba Tao, he decided to kill him. Dharmakṣema was murdered in 433, when he was forty-eight years old.

LATER BUDDHIST TRADTION

The near identity of the Buddhist and the Vedic traditions is known to discerning scholars. The two are identical in the worldly (*laukika*) sphere; there are differences in philosophical emphasis that matter in the otherworldly (*lokottara*) sphere. This was known widely which explains the spread of the Maheśvara image from India to Central Asia and China over 1,500 hundred years ago.[8]

Ananda Coomaraswamy compared the two thus:[9] "The more superficially one studies Buddhism, the more it seems to differ from the Brahmanism in which it originated; the more profound our study, the more difficult it becomes to distinguish Buddhism from Brahmanism, or to say in what respects, if any, Buddhism is really unorthodox."

Coomaraswamy reminds that the Buddha claimed to be speaking of the Sanātana dharma (*akālika dharma*).[9] "[He] describes as a vile heresy the view that he is teaching a 'philosophy of his own,' thought out by himself. No true philosopher ever came to destroy, but only to fulfill the Law. 'I have seen,' the Buddha says, 'the ancient Way, the Old Road that was taken by the formerly All-Awakened, and that is the path I follow'; and since he elsewhere praises the Brāhmaṇs of old who remembered the Ancient Way that leads to Brahma, there can be no doubt that the Buddha is alluding to 'the ancient narrow path that stretches far away, whereby the contemplatives, knowers of Brahma, ascend, set free' (*vimuktāḥ*), mentioned in verses that were already old when Yājñavalkya cites them in the earliest Upaniṣad."

The influential Lotus Sūtra (*Saddharma Puṇḍarīka Sūtra*) maps the perennial nature of Vedic knowledge into the ideas that there are several means (*upāyakauśalya* or *upāya*) adapted to the needs of the disciple, and Buddha lives on amongst us in the forms of bodhisattvas, who have attained enlightenment for the benefit of all beings.

The 25th chapter of the Lotus Sūtra describes Avalokiteśvara as a bodhisattva who embodies the compassion of all Buddhas. But bodhisattvahood itself requires worship of the Self within. The Nīlakaṇṭha Dhāraṇī is a chant popular all over East Asia said to have been recited by Avalokiteśvara in praise of the compassion shown by Harihara (Viṣṇu and Śiva), especially as Śiva who drank *halāhala* poison at the churning of the ocean to save the world, which has made his neck blue (*nīlakaṇṭha* in Sanskrit):[10]

> siddhāya svāhā | mahāsiddhāya svāhā | siddha-yogeśvarāya svāhā | Nīlakaṇṭhāya svāhā | Vāraha-mukhāya svāhā | Narasiṃha-mukhāya svāhā | padma-hastāya svāhā | cakra-hastāya svāhā | padma-hastāya? svāhā | Nīlakaṇṭha-vyāghrāya svāhā | Mahābali-Śankarāya svāhā ||

In the Kāraṇḍavyūha Sūtra, an adaptation of the Ṛgvedic Puruṣa Sūkta that most likely originated in Kashmir in 4th or 5th century, the sun and moon are said to be born from

Avalokiteśvara's eyes, Śiva from the brow, Brahmā from the shoulders, Nārāyaṇa from the heart, and Sarasvatī from the teeth. The mantra *Oṃ maṇi padme hūṃ* (ॐ मणि पद्मे हूँ) about the "jewel in the lotus" which is the heart of practice in many Asian traditions is to be found here.[11]

Three- or four-faced Maheśvara images have been found in Chinese caves. It is believed that philosophers Asaṅga and Āryadeva tried to amalgamate Shaivism and Vaishnavism with Buddhism.

The modern distance between Hinduism and Buddhism is the creation of Western academic Buddhologists and Indologists, whereas in the past the wise had the two merge into one as in Indonesia's Śiva-Buddha-āgama, which was the royal tradition for a long time. The Buddha realm is the realm of intelligence and thought, whereas the realm of Śiva is that of pure awareness, in which the first is necessary step to ascend to the second.

Bhinneka Tunggal Ika, the national motto of Indonesia, literally means "different, yet the same" referring to the Buddha and Śiva and it is usually rendered as "unity in diversity." The phrase is from the Kakawin Sutosoma, a fourteenth century poem in Old Javanese, by Mpu Tantular[12]. The stanza is as follows:

> Rwāneka dhātu winuwus Buddha Wiswa/
> Bhinnêki rakwa ring apan kena parwanosen,
> Mangka ng Jinatwa kalawan Śiwatatwa tunggal/
> Bhinnêka tunggal ika tan hana dharma mangrwa.
>
> The Buddha and the Universal (Śiva) are known as different realms/
> They are different, but how to know this difference
> For the truth of Jina (Buddha) and Śiva is one/
> They are different, yet same, for truth knows no duality.

The Buddha and the Viśva (here the universal consciousness as Śiva) appear different, yet are the same. This difference arises from the minds (ruled by emotions and the *buddhi*, or intelligence) who are different individuals and disappears when one sees that behind all experience lies the same consciousness, or Śiva.

The poet knew well that the heart of the Vedic insight is the place that lies beyond the paradoxical, which opens the doorway to deep understanding. Scales fall away when multiplicity and unity are understood as two sides of the same reality.

NOTES

1. See Kak (2002), Kak, (2009), Kak, (2018) for the convergence between modern science and Vedic thought; Buddhism offers a theory of emergence of mind from nothingness in seeming parallel with the beliefs of those scientists who think that consciousness is to be traced as emerging from complexity. See also Kak (2021b) for a view of the current research on consciousness from the perspective of artificial intelligence.
2. Yamamoto (1973) for the standard translation; see also Page (2006)
3. See, for example, Kak (2019)
4. Kak (2020) and Kak (2021)
5. Jikidõ (2000)
6. Kak (2007)
7. Yamamoto (1973)
8. See Kak (2021a). Gallo (2013) summarizes iconographical evidence related to the integration of Hinduism into Buddhism.
9. Coomaraswamy (1943)
10. Lokesh Chandra (1988)
11. Roberts (2012)
12. It is estimated to have been written between 1365 and 1389 during the golden age of the Majapahit Empire.

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T. Page, The Nirvana Sutra. (2006); https://www.nirvanasutra.net/theselfatman.htm
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7
The Nine Darśanas*

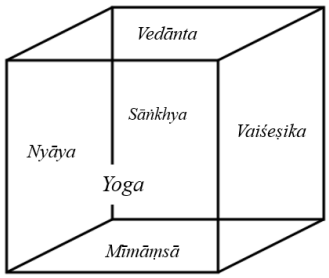
The orthodox schools of Indian views of reality are called *ṣaḍdarśana* ("six systems"), but this list is not as ancient as some schoolbooks suggest. These six analyze ritual (Mīmāṃsā), logic (Nyāya), matter together with its atomic constituents (Vaiśeṣika), creation at the personal and the cosmic levels (Sāṅkhya), synthesis (Yoga), and finally meaning of reality (Vedānta). Each of these include the subject – the experiencing self -- within the larger discussion. It is important to note that these six systems or views are universal and are not connected with any devotional practice. But since they include the subject within the framework, they provide a discipline that helps the individual to further his or her understanding.[1]

Vidyāraṇya, the fourteenth century scholar, in *Sarvadarśanasaṅgraha*, lists sixteen darśanas (schools) ranging from materialism (Cārvāka) to the Vedānta of Śaṅkara:[2]

> चार्वाकदर्शनम्, बौद्धदर्शनम्, अर्हतदर्शनम्, रामानुजदर्शनम्, पूर्णप्रज्ञदर्शनम्, नकुलीशपाशुपतदर्शनम्, शैवदर्शनम्, प्रत्यभिज्ञादर्शनम्, रसेश्वरदर्शनम्, औलूक्यदर्शनम्, अक्षपाददर्शनम्, जैमिनिदर्शनम्, पाणिनिदर्शनम्, सांख्यदर्शनम्, पातञ्जलदर्शनम्, शांकरदर्शनम्

Since the Vedas speak of consciousness as transcendent and not a property of the material ground (the brain), the number of ways it can be viewed by the pañca-mahābhūtas based mind is limitless and Vidyāraṇya's list is a snapshot representing traditions that were popular at his time, and is not exhaustive. The last seven of this list include the *ṣaḍdarśana* together with Pāṇini's grammatical philosophy of language.

It is instructive to speculate on the origin of the *ṣaḍdarśana*. Six is a fundamental count for it is the six different directions in space and thus it provides six orthogonal perspectives. The complementary darśana pairs are on opposite sides.



The ṣaḍdarśana

The Jain scholar Haribhadra Sūri (eighth century CE) in his *Ṣaḍdarśanasamuccaya* (summary of the six darśanas) presents six where Yoga and Vedānta are replaced by

* Academia.edu (201)

Buddhism and Jainism, and this indicates that the orthodox six mentioned earlier were already canonical in his time.

In reality, all small numbers are fundamental in the Indian tradition. For example, two is puruṣa and prakṛti (materiality and consciousness or any of the three complementary binaries such as Nyāya-Vaiśeṣika, Mīmāṃsā - Vedānta, Sāṅkhya-Yoga), three is trayī-vidyā or Tridevi, or Trimurti, four is the cardinal directions, five is the mahābhūtas, seven is svaras or colors), eight is siddhis or directions (four main and four diagonal), nine is rasa or treasures (Navanidhi), and so on.

Of these, nine is a special count for it alludes to new beginnings (*nava* also means new); the Latin cognate *novem* also connotes newness and "to the nines" in English means "perfection".

The darśanas are at the intersection of puruṣa and prakṛti and they represent the lens through which the mind which is constituted of prakṛti experiences the light of puruṣa. The nature of the interface between the two depends on the training of the mind and given that pervasive technology has transformed our experience in our times, it is good to enrich the view by using additional lenses of new darśanas.

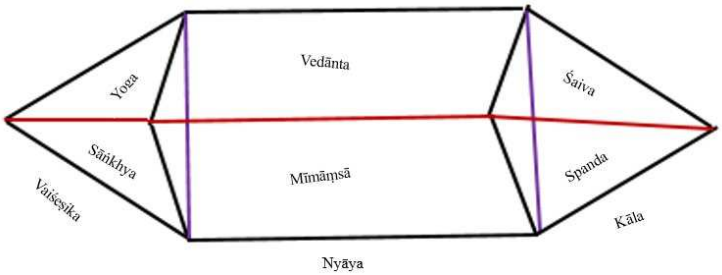
INDRA'S VAJRA

Nine is 3×3 that represents the fundamental trichotomy of reality three times over. If one wishes to engage with the world strongly, one must come out of the security of the cube. What comes to mind is the vajra shape and, in particular, Indra's Vajra, that is reputed to have immense power.

Vajra in Newark (New Jersey) Museum (left), and one from Tibet (right)

Indra on his elephant Airāvata holding vajra.
Painted in Thanjavur, early 19th century. British Museum

The vajra's geometry is a three-sided prism capped by tetrahedrons on either side. Each of its surfaces represents a darśana; the *ṣaḍdarśana* are on the prism and one cap and the three new darśanas are on the opposite cap. The original complementary pairs of the ṣaḍdarśana are next to each other.



The nine darśanas as Indra's vajra

I propose that the additional three darśanas are Spanda, Kāla, and Śaiva, which analyze reality as vibration (frequency and number), time (change and transformation), and Consciousness. Their position in relation to existing darśanas: Śaiva is next to Vedānta (for it is a form of it), Kāla is next to Nyāya (for all logic presupposes time), and Spanda is next to Mīmāṃsā (for it is the pulsating movement of Consciousness that drives ritual).

Frequency and number, time and consciousness are fundamental to our experience of reality and they also represent the frontier of many disciplines of science such as physics, neuroscience, psychology, computer science. They need more focused attention than provided by the six darśanas.

SPANDA DARŚANA

Spanda darśana is the analysis of the universe as motion and vibration. In the 9th century, the Śaivite sage Vasugupta or his student Bhaṭṭa Kallaṭa wrote the *Spanda-kārikā,* and we know that the commentary on it, *Spanda-vṛtti*, was written by Bhaṭṭa Kallaṭa.[3]

The flow of the power of consciousness occurs as a consequence of the interplay between subject, object and the means of the interaction that leads to cognition that ebbs and flows. There is also vibration associated with all outer reality. Prakāśa, as light, may also be viewed from the perspective of frequency and this opens up aspect of modern science as subject of inquiry within the ambit of Spanda darśana.

KĀLA DARŚANA

Atharvaveda 19.53 (Śaunaka) has a hymn on Kāla (Time) where the *bhúvanāni* are the beings, or the worlds; the following hymn 19.54 echoes it.

AV 19. 53

kāló áśvo vahati saptáraśmiḥ sahasrākṣó ajáro bhűriretāḥ /
tám ā́ rohanti kaváyo vipaścítas tásya cakrā́ bhúvanāni víśvā //1//

saptá cakrā́n vahati kālá eṣá saptā́sya nā́bhīr amŕ̥taṃ nv ákṣaḥ /
sá imā́ víśvā bhúvanāny añjat kāláḥ sá īyate prathamó nú deváḥ //2//

pūrṇáḥ kumbhó 'dhi kālá ā́hitas táṃ vaí páśyāmo bahudhā́ nú sántam /
sá imā́ víśvā bhúvanāni pratyáṅ kāláṃ tám āhúḥ paramé vyòman //3//

sá evá sáṃ bhúvanāny ā́bharat sá evá sáṃ bhúvanāni páry ait /
pitā́ sánn abhavat putrá eṣāṃ tásmād vaí nā́nyát páram asti téjaḥ //4//

kāló 'mū́ṃ dívam ajanayat kālá imā́ḥ pr̥thivī́r utá /
kālé ha bhūtáṃ bhávyaṃ ceṣitáṃ ha ví tiṣṭhate //5//

kāló bhūtím asr̥jata kālé tápati sū́ryaḥ /
kālé ha víśvā bhūtā́ni kālé cákṣur ví paśyati //6//

kālé mánaḥ kālé prāṇáḥ kālé nā́ma samā́hitam /
kāléna sárvā nandanty ā́gatena prajā́ imā́ḥ //7//

kālé tápaḥ kālé jyéṣṭham kālé bráhma samā́hitam /
kāló ha sárvasyeśvaró yáḥ pitā́sīt prajā́pateḥ //8//

téneṣitáṃ téna jātáṃ tád u tásmin prátiṣṭhitam /
kāló ha bráhma bhūtvā́ bíbharti parameṣṭhínam //9//

kāláḥ prajā́ asr̥jata kāló ágre prajā́patim /
svayaṃbhū́ḥ kaśyápaḥ kālā́t tápaḥ kālā́d ajāyata //10//

1. Kāla, the steed, runs with seven reins (rays), thousand-eyed, ageless, rich in seed. The learned seers mount him; all the beings (worlds) are his wheels.
2. With seven wheels does this Kāla flow, he has seven naves, and immortality is his axle. He carries here all these worlds. Kāla, the first divinity, now hastens onward.
3. A full jar has been placed upon Kāla; him, truly, we see existing in many forms. He carries away all these worlds; they call him Kāla in the highest heaven.
4. He surely brought here all the worlds, he surely encompasses all the worlds. Although their father, he became the son; there is, truly, no other force, higher than he.
5. Kāla created the heavens, Kāla also created this earth. That which is past, and that which shall be, driven by Kāla, spreads out.
6. Kāla created the earth, in Kāla the sun burns. In Kāla are all beings, in Kāla the eye looks out.
7. In Kāla the mind, in Kāla the breath, in Kāla the names are fixed; when Kāla has arrived, all the creatures rejoice.

8. In Kāla the tapas, in Kāla the highest, in Kāla brahma is fixed; Kāla is the lord of everything, he was the father of Prajāpati.
9. By him this (universe) was ordered, by him it was born, and upon him this was founded. Kāla, truly, having become the brahma (spiritual exaltation), supports Parameṣṭhin (the highest lord).
10. Kāla created the creatures (*prajā*), and Kāla in the beginning was Prajāpati; the self-existing Kaśyapa and the tapas were born from Kāla.

Time is the greatest mystery. In Bhagavad Gītā 11.32, Krishna says of Kāla:

कालो ऽस्मि लोकक्षयकृत् प्रवृद्धो लोकान् समाहर्तुम् इह ।
kālo 'smi loka-kṣhaya-kṛit pravṛiddho lokān samāhartum iha

I am mighty Time (Kāla), the source of destruction that comes forth to annihilate the worlds.

The Ṛgveda 6.47.18 says that the Puruṣa is the original form (Rūpa) of all forms, and it is that form that we see everywhere (that has been transformed by time):

रूपं-रूपं परतिरूपो बभूव तदस्य रूपं प्रतिचक्षणाय | RV 6.47.18
rūpam rūpam pratirūpo babhūva, tadasya rūpam praticakṣaṇāya

The Kaṭha Upaniṣad provides an explanation:

वायुर्यथैको भुवनं प्रविष्टो
रूपं रूपं प्रतिरूपो बभूव ।
एकस्तथा सर्वभूतान्तरात्मा
रूपं रूपं प्रतिरूपो बहिश्च ॥ १०॥Kaṭha Up. 2.2.10

vāyuryathaiko bhuvanaṃ praviṣṭo
rūpaṃ rūpaṃ pratirūpo babhūva.
ekastathā sarvabhūtāntarātmā
rūpaṃ rūpaṃ pratirūpo bahiśca

As wind, though one, having entered the world, assumes forms that correspond to each form, so the inner atman of all living things, though one, assumes forms that correspond to every form and is outside them all.

In the Bhagavad Gītā, the Viśvarūpa form is a mapping of time into space for the transcendent is beyond these distinctions.

So how do these forms emerge and how are they related to each other in their embodiments? This darśana should deal with the tattvas underlying all living forms, and

should include exposition on how they emerged for the first time in the past.

ŚAIVA DARŚANA

This is seeing reality as contained in consciousness as in the Pratyabhijñā that goes back to the *Īśvara-pratyabhijñā-kārikā* by Utpaladeva (10th century) and which was listed as a separate darśana by Vidyāraṇya. This is the view that a person can by shifting one's perspective find himself or herself as Śiva.

NOTES

1. For background to earlier work, see Kak (2007) which deals with change and transformation and Kak (2016) that develops this theme further. Kak (2018) is an introduction to the Vedas.
2. For a translation of Vidyāraṇya's text, see Cowell (1882).
3. Dyczkowski (1987).
4. Singh (2008).

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PART 2

LARGE CONNECTIONS

8
Archaeoastronomy in India*

Our understanding of archaeoastronomical sites in India is based not only on a rich archaeological record and texts that go back thousands of years, but also on a living tradition that is connected to the past. Conversely, India has much cultural diversity and a tangled history of interactions with neighboring regions that make the story complex. The texts reveal to us the cosmological ideas that lay behind astronomical sites in the historical period and it is generally accepted that the same ideas also apply to the Harappan era of the third millennium BCE (Kenoyer, 1998: 52-53).

In the historical period, astronomical observatories were part of temple complexes where the king was consecrated. Such consecration served to confirm the king as foremost devotee of the chosen deity, who was taken to be the embodiment of time and the universe (Kak, 2002a: 58). For example, Udayagiri is an astronomical site connected with the Classical age of the Gupta dynasty (320-500 CE), which is located a few kilometers from Vidisha in central India (Willis, 2001; Dass and Willis, 2002). The imperial Guptas enlarged the site, an ancient hilly observatory going back at least to the 2nd century BCE at which observations were facilitated by the geographical features of the hill, into a sacred landscape to draw royal authority.

Indian astronomy is characterized by the concept of ages of successive larger durations, which is an example of the pervasive idea of recursion, or repetition of patterns across space, scale and time. An example of this is the division of the ecliptic into 27 star segments (*nakṣatras*), with which the moon is conjoined in its monthly circuit, each of which is further sub-divided into 27 sub-segments (*upa-nakṣatras*), and the successive divisions of the day into smaller measures of 30 units. The idea of recursion underlies the concept of the sacred landscape and it is embodied in Indian art, providing an archaeoastronomical window on sacred and monumental architecture. It appears that this was an old idea because intricate spiral patterns, indicating recursion, are also found in the paintings of the Mesolithic period. Tyagi (1992) has claimed that they are unique to Indian rock art.

According to the *Vāstu Śāstra*, the structure of the building mirrors the emergence of cosmic order out of primordial chaos through the act of measurement. The universe is symbolically mapped into a square that emphasizes the four cardinal directions. It is represented by the square *vāstu-maṇḍala*, which in its various forms is the basic plan for the house and the city. There exist further elaborations of this plan, some of which are rectangular.

It is significant that *yantric* buildings in the form of *mandalas* have been discovered in North Afghanistan that belong to a period that corresponds to the late stage

* arXiv.edu (2010)

of the Harappan tradition (Kak, 2000a; 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 Harappan system shows that these ideas were widely spread.

Contents

1. CHRONOLOGY AND OVERVIEW

India's archaeological record in the northwest has unbroken continuity going back to about 7500 BCE at Mehrgarh (Kenoyer, 1998; Lal, 2002), and it has a rock art tradition, next only to that of Australia and Africa in abundance, that is much older (Pandey, 1993; Bednarik, 2000). Some rock art has been assigned to the Upper Paleolithic period. There is surprising uniformity, both in style and content, in the rock art paintings of the Mesolithic period (10,000 – 2500 BCE) (Tyagi, 1992; Wakankar, 1992).

The archaeological phases of the Indus (or Sindhu-Sarasvati) tradition have been divided into four eras: *early food-producing era* (c. 6500- 5000 BCE), *regionalization era* (5000 – 2600 BCE), *integration era* (2600 – 1900 BCE), and *localization era* (1900 – 1300 BCE) (Shaffer, 1992). The early food-producing era lacked elaborate ceramic technology. The regionalization era was characterized by styles in ceramics, lapidary arts, glazed faience and seal making that varied across regions. In the integration era, there is significant homogeneity in material culture over a large geographical area and the use of the so-called Indus script, which is not yet deciphered. In the localization era, patterns of the integration era are blended with regional ceramic styles, indicating decentralization and restructuring of the interaction networks. The localization era of the Sindhu-Sarasvati tradition is the regionalization era of the Ganga-Yamuna tradition which transforms into the integration era of the Magadha and the Mauryan dynasties. There is also continuity in the system of weights and lengths between the Harappan period and the later historic period (Mainkar, 1984).

The cultural mosaic in the third millennium BCE is characterized by the integration phase of the Harappan civilization of northwest India, copper and copper/bronze age cultures or central and north India, and Neolithic cultures of south and

east India (Lal, 1997). Five large cities of the integration phase are Mohenjo-Daro, Harappa, Ganweriwala, Rakhigarhi, and Dholavira. Other important sites of this period are Kalibangan, Rehman Dheri, Nausharo, Kot Diji, and Lothal.

A majority of the towns and settlements of the Harappan period were in the Sarasvati valley region. Hydrological changes, extended period of drought, and the drying up of the Sarasvati River due to its major tributaries being captured by the Sindh and Ganga Rivers after an earthquake in 1900 BCE led to the abandonment of large areas of the Sarasvati valley (Kak, 1992). The Harappan phase went through various stages of decline during the second millennium BCE. A second urbanization began in the Ganga and Yamuna valleys around 900 BCE. The earliest surviving records of this culture are in Brāhmī script. This second urbanization is generally seen at the end of the Painted Gray Ware (PGW) phase (1200- 800 BCE) and with the use of the Northern Black Polished Ware (NBP) pottery. Late Harappan was partially contemporary with the PGW phase. In other words, a continuous series of cultural developments link the two early urbanizations of India.

The setting for the hymns of the *Ṛgveda*, which is India's most ancient literary text, is the area of Sapta Saindhava, the region of north India bounded by the Sindh and the Ganga rivers although regions around this heartland are also mentioned. The *Ṛgveda* describes the Sarasvati River to be the greatest of the rivers and going from the mountains to the sea. The archaeological record, suggesting that this river had turned dry by1900 BCE, indicates that the *Ṛgveda* is prior to this epoch. The *Ṛgveda* and other early Vedic literature have astronomical references related to the shifting astronomical frame that indicate epochs of the fourth and third millennium BCE which is consistent with the hydrological evidence. The nakṣatra lists are found in the Vedas, either directly or listed under their presiding deities, and one may conclude that their names have not changed. Vedic astronomy used a luni-solar year in which an intercalary month was employed as adjustment with solar year.

The shifting of seasons through the year and the shifting of the northern axis allow us to date several statements in the Vedic books (Sastry, 1985). Thus the *Śatapatha Brāhmaṇa* (2.1.2.3) has a statement that points to an earlier epoch where it is stated that the Kṛttikā (Pleiades) never swerve from the east. This corresponds to 2950 BCE. The *Maitrāyaṇīya Brāhmaṇa Upaniṣad* (6.14) refers to the winter solstice being at the mid-point of the Śraviṣṭhā segment and the summer solstice at the beginning of Maghā. This indicates 1660 BCE. The *Vedāṅga Jyotiṣa* mentions that winter solstice was at the beginning of Śraviṣṭhā and the summer solstice at the mid-point of Āśleṣā. This corresponds to about 1300 BCE.

The nakṣatras in the Vedāṅga Jyotiṣa are defined to be 27 equal parts of the ecliptic. The nakṣatra list of the late Vedic period begin with Kṛttikā (Pleiades) whereas that of the astronomy texts after 200 CE begin with Ashvini (α and β Arietis), indicating a transition through 2 nakṣatras, or a time span of about 2,000 years.

The foundation of Vedic cosmology is the notions of *bandhu* (homologies or

binding between the outer and the inner). In the Āyurveda, medical system associated with the Vedas, the 360 days of the year were taken to be mapped to the 360 bones of the developing fetus, which later fuse into the 206 bones of the person. It was estimated correctly that the sun and the moon were approximately 108 times their respective diameters from the earth (perhaps from the discovery that the angular size of a pole removed 108 times its height is the same as that of the sun and the moon), and this number was used in sacred architecture. The distance to the sanctum sanctorum of the temple from the gate and the perimeter of the temple were taken to be 54 and 180 units, which are one-half each of 108 and 360 (Kak, 2005a). Homologies at many levels are at the basis of the idea of *recursion,* or repetition in scale and time. The astronomical basis of the Vedic ritual was the reconciliation of the lunar and solar years (Kak, 2000a; Kak, 2000b).

Texts of the Vedic and succeeding periods provide us crucial understanding of the astronomy and the archaeoastronomy of the historical period throughout India. The medieval period was characterized by pilgrimage centers that created sacred space mirroring conceptions of the cosmos. Sacred temple architecture served religious and political ends.

The instruments that were used in Indian astronomy include the water clock (*ghaṭi yantra)*, gnomon (*śaṅku*), cross-staff (*yaṣṭi yantra*), armillary sphere (*gola-yantra*), board for sun's altitude (*phalaka yantra*), sundial (*kapāla yantra*), and astrolabe (Gangooly, 1880). In early 18th century, Maharaja Sawai Jai Singh II of Jaipur (r. 1699-1743) built five masonry observatories called Jantar Mantar in Delhi, Jaipur, Ujjain, Mathura, and Varanasi. The Jantar Mantar consists of the Rāma Yantra (a cylindrical structure with an open top and a pillar in its center to measure the altitude of the sun), the Rāśivalaya Yantra (a group of twelve instruments to determine celestial latitude and longitude), the Jaya Prakāśa (a concave hemisphere), the Laghu Samrāṭ Yantra (small sundial), the Samrāṭ Yantra (a huge equinoctial dial), the Cakra Yantra (upright metal circles to find the right ascension and declination of a planet), the Digaṃśa Yantra (a pillar surrounded by two circular walls), the Kapāla Yantra (two sunken hemispheres to determine the position of the sun relative to the planets and the zodiac), the Ṣaṣṭāṃśa Yantra (to display a pinhole image of the Sun over a sixty-degree meridian scale), and the Nāḍīvalaya Yantra (a cylindrical dial).

2. PREHISTORIC AND HARAPPAN PERIODS

The city of Mohenjo-Daro (2500 BCE), like most other Harappan cities (with the exception of Dholavira as far as we know at this time) was divided into two parts: the acropolis and the lower city. The Mohenjo-Daro acropolis, a cultural and administrative centre, had as its foundation a 12 meter high platform of 400 m × 200 m. The lower city had streets oriented according to the cardinal directions and provided with a network of covered drains. Its houses had bathrooms. The city's wells were so well constructed with tapering bricks that they have not collapsed in 5000 years. The Great Bath (12 m × 7 m) was built using finely fitted bricks laid on with gypsum plaster and made watertight with

bitumen. A high corbelled outlet allowed it to be emptied easily. Massive walls protected the city against flood water.

The absence of monumental buildings such as palaces and temples makes the Harappan city strikingly different from its counterparts of Mesopotamia and Egypt, suggesting that the polity of the Harappan state was de-centralized and based on a balance between the political, the mercantile, and the religious elites. The presence of civic amenities such as wells and drains attests to considerable social equality. The power of the mercantile guilds is clear in the standardization of weights of carefully cut and polished chart cubes that form a combined binary and decimal system.

Mohenjo-Daro and other sites show slight divergence of 1° to 2° clockwise of the axes from the cardinal directions (Wanzke, 1984). It is thought that this might have been due to the orientation of Aldebaran (*Rohiṇi* in Sanskrit) and the Pleiades (*Kṛttikā* in Sanskrit) that rose in the east during 3000 BCE to 2000 BCE at the spring equinox; the word "rohiṇi" literally means rising. Furthermore, the slight difference in the orientations amongst the buildings in Mohenjo-Daro indicates different construction periods using the same traditional sighting points that had shifted in this interval (Kenoyer, 1998).

Mohenjo-Daro's astronomy used both the motions of the moon and the sun (Maula, 1984). This is attested by the use of great calendar stones, in the shape of ring, which served to mark the beginning and end of the solar year.

Dholavira

Dholavira is located on an island just north of the large island of Kutch in Gujarat. Its strategic importance lay in its control of shipping between Gujarat and the delta of the Sindh and Sarasvati rivers.

The layout of Dholavira is unique in that it comprises of three "towns," which is in accord with Vedic ideas (Bisht, 1997; Bisht, 1999a; Bisht, 1999b). The feature of recursion in the three towns, or repeating ratios at different scales, is significant. 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, which was also true of Classical India (Bhat, 1995).

A Dholavira length, D, has been determined by finding the largest measure which leads to integer dimensions for the various parts of the city. This measure turns out be the same as the *Arthaśāstra* (300 BCE) measure of *dhanus* (bow) that equals 108 *aṅgulas* (fingers). This scale is confirmed by a terracotta scale from Kalibangan and the ivory scale found in Lothal. The Kalibangan scale (Joshi, 2007; 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.

The analysis of the unit of length at Dholavira is in accord with the unit from the historical period (Danino, 2005; Danino, 2008). 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 Harappa follow ratios of 1:2:4 with the dominating size being 7 × 14 × 28 cm (Kenoyer, 1998). These dimensions can be elegantly expressed as 4 × 8 × 16 *aṅgulas*, with the unit of *aṅgula* taken as 1.763 cm. It is significant that the ivory scale at Lothal has 27 graduations in 46 mm, or each graduation is 1.76 mm.

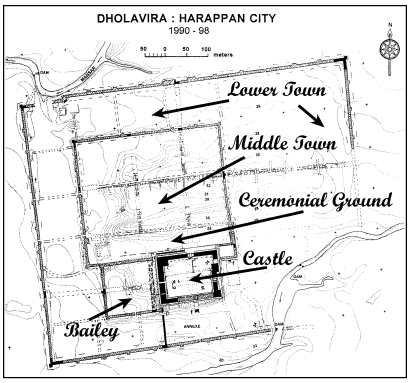

Figure 1. Map of Dholavira (Bisht, 1997)

With the new Dholavira unit of D, the dimensions of Mohenjo-Daro's acropolis turn out to be 210 × 105 D; Kalibangan's acropolis turn out to be 126 × 63 D. The dimensions of the lower town of Dholavira are 405 × 324 D; the width of the middle town is 180 D; and the inner dimensions of the castle are 60 × 48 D. The sum of the width and length of the lower town comes to 729 which is astronomically significant since it is 27 × 27, and the width 324 equals the nakshatra year 27 × 12.

Continuity has been found between the grid and modular measures in the town planning of Harappa and historical India, including that of Kathmandu Valley (Pant and Funo, 2005). The measure of 19.2 meters is the unit in quarter-blocks of Kathmandu; 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.

Rehman Dheri

A 3rd millennium seal from Rehman Dheri, showing a pair of scorpions on one side and two antelopes on the other, that suggests knowledge of Vedic themes. It has been suggested that this seal represents the opposition of the Orion (Mṛgaśiras, or antelope head) and the Scorpio (Rohiṇi of the southern hemisphere which is 14 nakṣatras from the Rohiṇi of the northern hemisphere) nakṣatras. The arrow near the head of one of the antelopes could represent the decapitation of Orion. It is generally accepted that the myth of Prajāpati being killed by Rudra represents the shifting of the beginning of the year away from Orion, placing the astronomical event in the fourth millennium BCE (Kak, 2000a).

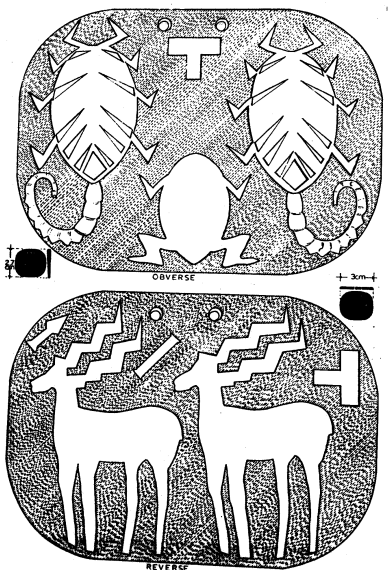

Figure 2. Astronomical seal from Rehman Dheri

3. NEOLITHIC AND MEGALITHIC SITES

Interesting sites of archaeoastronomical interest include the Neolithic site of Burzahom from Kashmir in North India, and megalithic sites from Brahmagiri and Hanamsagar from Karnataka in South India.

Burzahom, Kashmir

This Neolithic site is located about 10 km northeast of Srinagar in the Kashmir Valley on a terrace of Late Pleistocene-Holocene deposits. Dated to around 3000 - 1500 BCE, its deep pit dwellings are associated with ground stone axes, bone tools, and gray burnished pottery. A stone slab of 48 cm × 27 cm, obtained from a phase dated to 2125 BCE shows two bright objects in the sky with a hunting scene in the foreground. These have been assumed to be a depiction of a double star system (Kameshwar Rao, 2005).

Figure 3. Burzahom sky scene

Brahmagiri, Karnataka

The megalithic stone circles of Brahmagiri in the Chitradurga district of Karnataka in South India, which have been dated to 900 BCE, show astronomical orientations. This site is close to Siddapur where two minor Aśokan rock edicts were found in 1891. Kameswara Rao (1993) has argued that site lines from the centre of a circle to an outer tangent of another circle point to the directions of the sunrise and full moon rise at the time of the solar and lunar solstices and equinox.

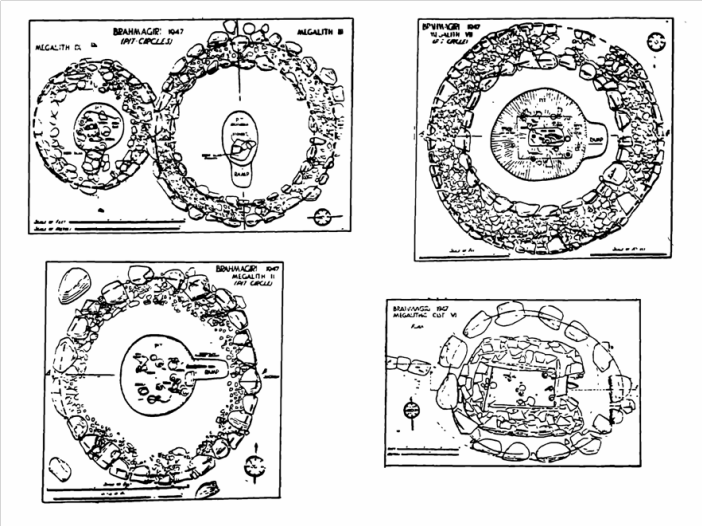

Figure 4. Megalithic stone circles of Brahmagiri

Hanamsagar, Karnataka

Hanamsagar is a megalithic site with stone alignments pointing to cardinal directions. It is located on a flat area between hills about 6 km north of the Kṛṣṇā river at latitude 16º 19′ 18″ and longitude 76º 27′ 10″. The stones, which are smooth granite, are arranged in a square of side that is about 600 meters with 50 rows and 50 columns (for a total of 2,500 stones), with a separation between stones of about 12 m. The stones are between 1 to 2.5 m in height with a maximum diameter of 2 to 3 m. The lines are oriented in cardinal directions. There is a squarish central structure known as *cakri kaṭṭi*.

It has been argued that the directions of summer and winter solstice can be fixed in relation to the outer and the inner squares. Kameswara Rao (2005) suggests that it could have been used for several other kind of astronomical observations such as use of shadows to tell the time of the day, the prediction of months, seasons and passage of the year.

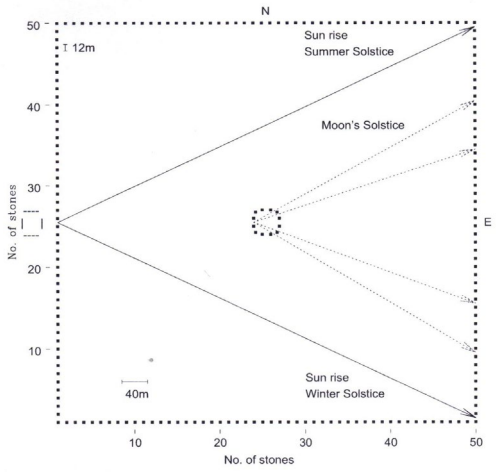

Figure 5. Alignments at Hanamsagar

4. THE PLAN OF THE TEMPLE

The sacred ground for Vedic ritual is the precursor to the temple. The Vedic observances were connected with the circuits of the sun and the moon (Kak, 1993; Kak, 1995; Kak, 1996). The altar ritual was 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 that were done at different times of the day.

In the ritual at home, the householder employed three altars that are circular (earth), half-moon (atmosphere), and square (sky), which are like the head, the heart, and the body of the Cosmic Man (*Puruṣa*). In the Agnicayana, the great ritual of the Vedic times that forms a major portion of the narrative of the *Yajurveda*, the atmosphere and the sky altars are built afresh in a great ceremony to the east. This ritual is based upon the Vedic division of the universe into three parts of earth, atmosphere, and sky that are assigned numbers 21, 78, and 261, respectively. The numerical mapping is maintained by placement of 21 pebbles around the earth altar, sets of 13 pebbles around each of 6 intermediate ($13 \times 6=78$) altars, and 261 pebbles around the great new sky altar called the Uttara-vedi, which is built in the shape of a falcon; these numbers add up to 360, which is symbolic representation of the year. The proportions related to these three numbers, and others related to the motions of the planets, and angles related to the sightings of specific stars are reflected in the plans of the temples of the historical period (Kak, 2002b; Kak, 2006a; Kak, 2009; Kaulācara, 1966).

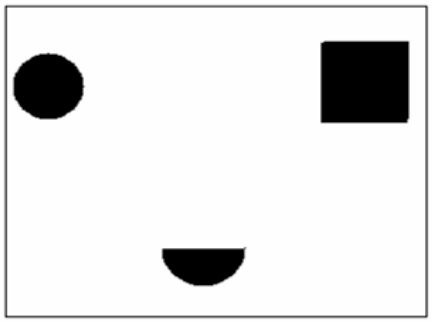

Figure 6. The three altars of the Vedic house: circular (earth, body), half-moon (atmosphere, prāṇa), square (sky, consciousness)

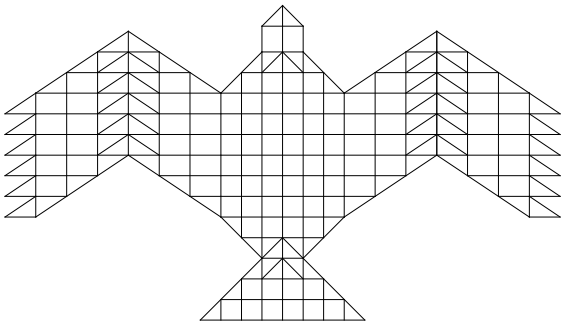

Figure 7. The falcon altar of the Agnichayana altar

The Agnicayana altar is the prototype of the temple and of the 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. The altar is constructed in a sequence of 95 years, whose details are matched to the reconciliation of the lunar and solar years by means of intercalary months.

In the ritual ground related to the Agnicayana ceremony, the Uttara-vedi is 54 units from the entrance in the west and the perimeter of the ritual ground is 180 units (Kak, 2005a). These proportions characterize many later temples. The connection of the nakṣatras to the solar months is provided in Figure 8 for which we have textual evidence in the Ṛgveda.

The Temple Complex at Khajuraho

The town of Khajuraho extends between 79° 54’ 30” to 79° 56’ 30” East and 24° 50’ 20” to 24° 51’ 40” North, in Chhatarpur district, in Madhya Pradesh. The temples of Khajuraho were built in 9th -12th century CE by the Chandela kings. Originally there were 84 temples, of which 23 have survived. Of the surviving temples, 6 are associated with Śiva, 8 with Viṣṇu, and 5 with the goddess (Singh, 2009b).

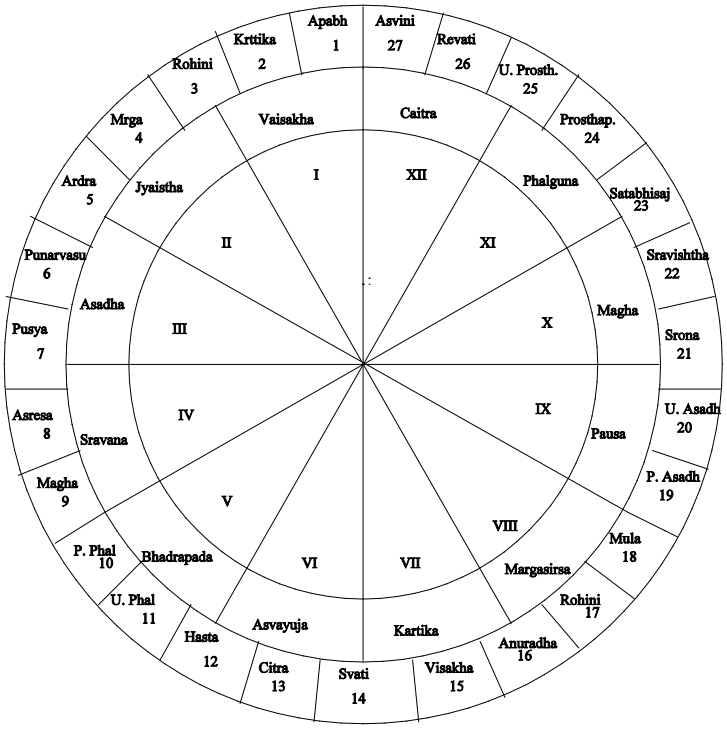

Figure 8. Mapping of the nakṣatras to the solar months

At the eastern edge of the temple complex are the Dantla hills, with a peak of 390 m at which is located a shrine to Śiva, which is a reference point for the temple entrances. All the temples excepting the Caturbhuja face the east. The southeastern edge has the Lāvanya hill that is separated from the Dantla hills by the eastward flowing river Khudar. At the foothills of the Lāvanya hill at a height of 244m is the shrine of goddess Durgā as Mahiṣāsurmardini.

The shrines to Śiva and Durgā on the Dantla and Lāvanya hills span the polarities of spirit (*Puruṣa*) and matter (*Prakṛti*), which are bridged by the river between the hills. The temples of Khajuraho are popular pilgrimage centers during two spring festivals: Śivarātri that falls on the new moon of Phālguna (February/March), and Holi, which falls on the full moon of Caitra (March/April).

The Lakṣmaṇa temple, one of the oldest of the complex, is considered the *axis mundi* of the site. It was built by the king Yaśovarman (925-950) as symbol of the Chandela victory over the Pratihāras and a record of supremacy of their power. This temple is oriented to the sunrise on Holi.

The groups of temples form three overlapping mandalas, with centers at the Lakṣmaṇa (Viṣṇu), the Javeri (Śiva), and the Dulādeva (Śiva) temples. Their deviation from true cardinality is believed to be due to the direction of sunrise on the day of consecration (Singh, 2009).

The temple, as a representation of the cosmos and its order, balances the *asuras*

(demons) and the *devas* (gods), as well as inheres in itself other polarities of existence. In the Lakṣmaṇa Temple, Viṣṇu is depicted in a composite form with the usual calm face bracketed by the faces of lion and boar. The conception of the sanctum is as a mandala (Desai, 2004).

The planetary deities, the *grahas*, encircle the temple in the following arrangement:

Surya (Sun)	
Soma (Moon)	*Maṅgala* (Mars)
Bṛhaspati (Jupiter)	*Budha* (Mercury)
Śani (Saturn)	*Śukra* (Venus)
Gaṇeśa	*Durgā*

Gaṇeśa and Durgā are the deities of the ascending and the descending nodes of the moon, respectively. The temple is envisioned like Mount Meru, the axis of the universe, and the planets move around it.

5. THE UDAYAGIRI OBSERVATORY

Udayagiri ("hill of [sun]-rise"] is one of the principal ancient astronomical observatories of India. It is located at 23°31' N latitude on the Tropic of Cancer in Madhya Pradesh, about 50 kilometers from Bhopal, near Vidisha, Besnagar and Sānchi. An ancient site that goes back to at least the second century BCE, it was substantially enlarged during the reign of the Gupta Emperor Candragupta II Vikramāditya (r. 375-414). This site is associated with 20 cave temples that have been cut into rock; nineteen of these temples are from the period of Candragupta's reign (Dass and Willis, 2002).

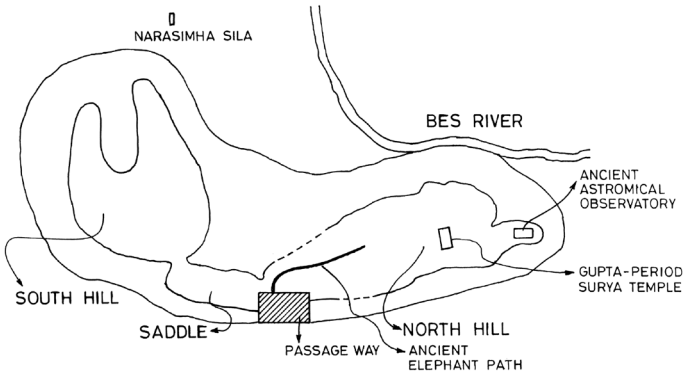

Figure 9. Udayagiri layout (Balasubramaniam, 2008)

It appears that the ancient name of Udayagiri was Viṣṇupādagiri, or the "hill of the footprint of Viṣṇu," and the name Udayagiri is after the Paramāra ruler Udayāditya (c. 1070-93). The hill is shaped like a foot. A saddle connects the northern and southern hills, and a passageway is located at the place where the northern hill meets the saddle.

The Gupta period additions and embellishments at Udayagiri were concentrated around this passage. Most of the cave temples are located around the passageway.

On the summer solstice day, there was an alignment of the sun's movement with the passageway. The day mentioned in the dated Chandragupta II Vikramāditya period inscription in cave 6 has been calculated to be very close to the summer solstice of the year 402 CE. On this day, the shadow of the Iron Pillar of Delhi, which was originally located at the entrance of the passageway, fell in the direction of the reclining Viṣṇu panel (Balasubramaniam, 2008).

On the northern hilltop, there exists a flat platform commanding a majestic view of the sky. Several astronomical marks have been identified at this platform, indicating that this was the site of the ancient astronomical observatory.

6. MEDIEVAL PILGRIMAGE COMPLEXES

Medieval pilgrimage centers fulfilled many functions including that of trade and business. They were important to the *jyotiṣi* (astrologer) who would make and read the pilgrims' horoscope. The better astrologers were also interested in astronomy and this knowledge was essential for the alignment of temples and palaces.

Every region of India has important pilgrimage centers, some of which are regional and others pan-Indic. The most famous of the pan-Indic centers are associated with Śiva (Varanasi), Kṛṣṇa (Mathura, Dwarka), Rāma (Ayodhya), Viṣṇu (Tirupati), and the 12-yearly rotation of the Kumbha Mela at Prayag, Haridwar, Ujjain, and Nashik. For pilgrimage centers such as Chitrakut, Gaya, Madurai, Varanasi, Vindhyāchal, and Khajuraho, the question of alignments of temples to cardinal directions or to direction of the sun on major festivals has been studied by scholars (Singh, 2009b). Here we will consider the sun temples of Varanasi (Malville, 1985; Singh, 2009a and 2009b).

The Sun Temples of Varanasi

Varanasi is an ancient city dating from the beginning of the first millennium BCE, whose Vedic name is Kāśi (Sanskrit for "radiance"), a name that continues to be used together with Banaras. Of its many temples, the most important is Kāśi Viśvanātha Temple, or "Golden Temple," dedicated to Lord Śiva, the presiding deity of the city. Because of repeated destruction by the sultans and later by Aurangzeb, the current Viśvanātha is a relatively modern building. It was built in 1777 by Maharani Ahilyabai of Indore, and its *śikhara* (spire) and ceilings were plated with of gold in 1839, which was a gift from Maharaja Ranjit Singh (Singh, 2009a and 2009b).

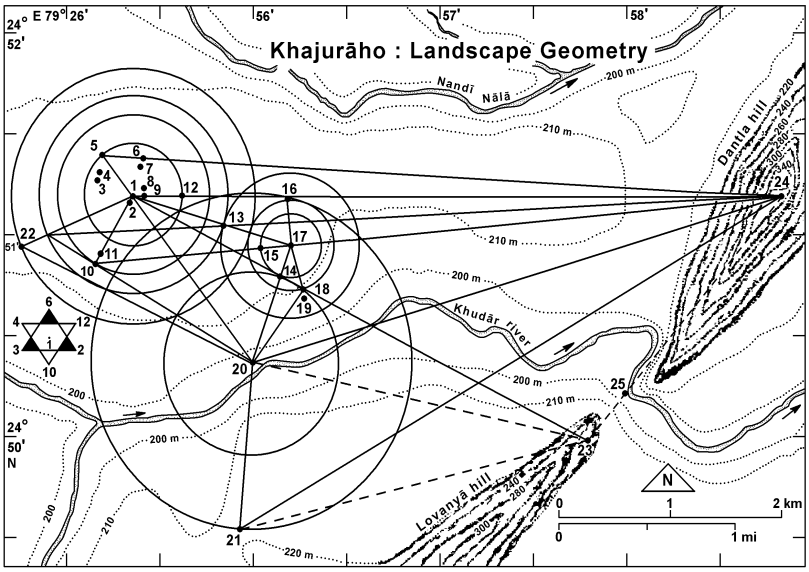

Figure 10. Khajuraho: Landscape geometry and topography (Singh, 2009b)

Śiva represents both the axis of the universe as well as that of one's inner being. One of the great festivals celebrated in Varanasi is Śivarātri which is celebrated on the 13th day of the dark fortnight of the Phalguna month (February-March). On that day you can see the sun rise in the east with the new moon just above it, which is represented iconographically by Śiva (as the sun) wearing the moon on his head.

There are several pilgrimage circuits in Varanasi for circumambulating the city. The Pañakrośi circuit has 108 shrines on it, and the four inner circuits have a total of 324 shrines. It is also known for the circuit of the Āditya shrines. The Ādityas are the 7 or 8 celestial gods, although their number is counted to 12 in later books. In Puranic India, they are taken to be the deities of the twelve solar months. The Āditya temples were also razed during the centuries of Muslim rule, but have been re-established at the same sites and are now part of the active ritualscapes (Singh, 2009a).

Several Āditya shrines have been located with the aid of descriptions in the *Kāśi Khaṇḍa* and pilgrimage guides (Singh and Malville, 1995; Singh, 2009a and 2009b). Six of these lie along one sides of an isosceles triangle with a base of 2.5km. The triangle surrounds the former temple of Madhyameśvara, which was the original center of Kashi. Pilgrims walking along the triangle are symbolically circumambulating the cosmos.

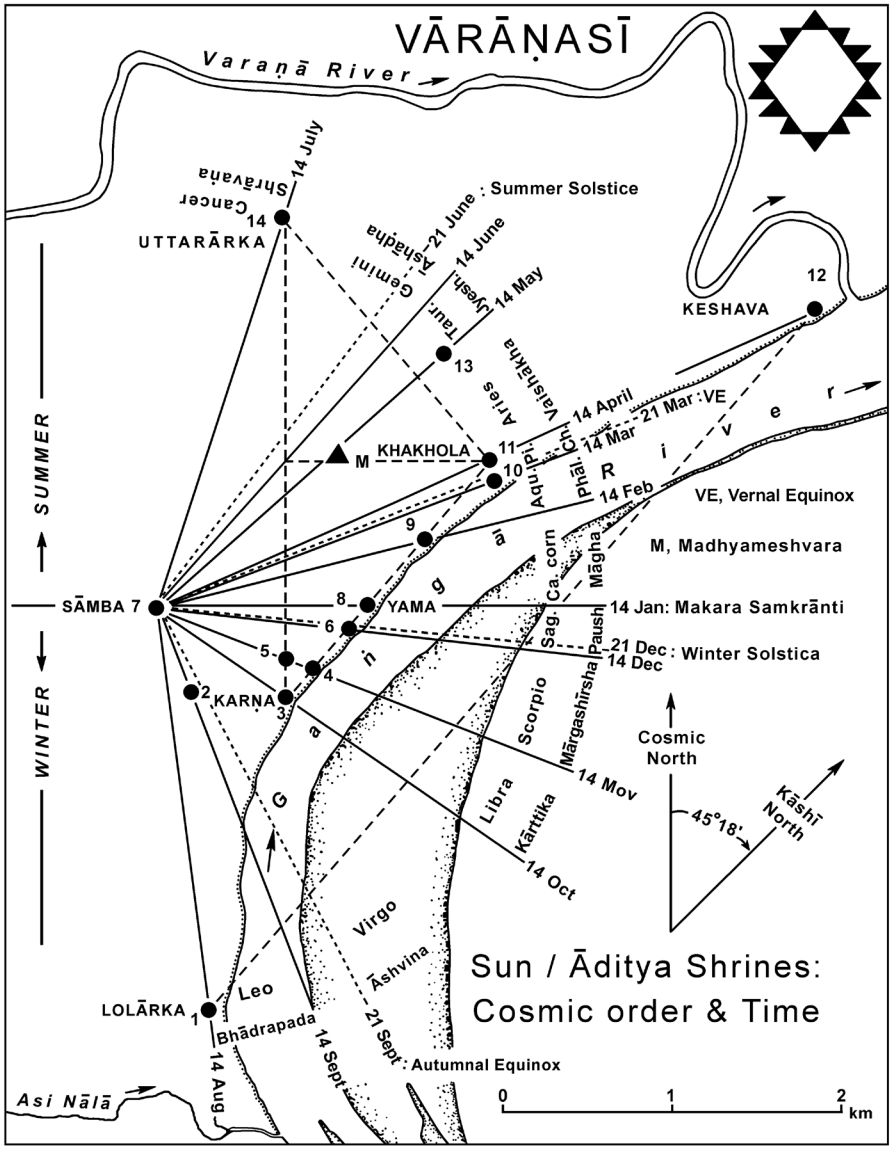

Figure 11. Sun Shrines: Cosmic order and cyclic orientation of time (Singh, 2009a)

7 SACRED CITIES

There are numerous sacred cities in the Indian sub-continent that were either built to an archetypal master plan or grew organically by virtue of being connected to a specific celestial deity. Some of the important sacred cities are:

1. Varanasi
2. Vijayanagara
3. Ayodhya
4. Mathura
5. Bhaktapur
6. Tirupati

7. Kanchipuram
8. Dwarka
9. Ujjain

Robert Levy viewed the Indian sacred city as a structured "mesocosm", situated between the microcosm of the individual and the macrocosm of the culturally conceived larger universe (Levy, 1991). Such a city is constructed of spatial connected *mandalas*, each of which is sustained by its own culture and performance. The movements of the festival year and rites of passage constitute a "civic dance", which defines the experience of its citizens.

The life-cycle passages and festivals dedicated to the gods affirm the householders' moral compass, identities and relationships. But there also exist other deities, represented generally by goddesses, who point to the forces of nature outside of moral order. These are brought into the larger order through tantric invocations and amoral propitiatory offerings. Performances invoking the goddess are the responsibility of the king and the merchants.

Sacrality and Royal Power at Vijayanagara

The city of Vijayanagara (also known as Hampi) was founded in the 14th century and sacked in 1565. The best known kings associated with Vijayanagara are Harihara I and II and Bukka Raya I (ca. 1336-1404), and Kṛṣṇadevarāya and his half-brother Acyutadevarāya (1509-42). From the mid-14th century to 1565, the city was the capital of the Vijayanagara Empire. According to the Persian ambassador Abdur Razaaq (1442 CE): "The City of Vijayanagara is such that the pupil of the eye has never seen such a place like it, and the ear of intelligence has never been informed that there existed anything to equal it in the world."

Hampi had for centuries been an important pilgrimage city due to its mythic association with river Goddess Pampā and her consort Virupakṣa, or Pampāpati. An inscription dated 1163 CE records a *mahādāna*, a religious offering in the presence of Lord Virupakṣa of Hampi by the Kalacuri King Bijjala. The region was part of the kingdom of Kampiladeva until 1326 when the armies of Mohammed Bin Tughlaq defeated the king and imprisoned the two sons of Sangama, Hukka and Bukka. Some years later the Sultan sent the two as governors of the province. In 1336 they broke free from Tughlaq allegiance and established the Sangama dynasty with its capital at Vijayanagara.

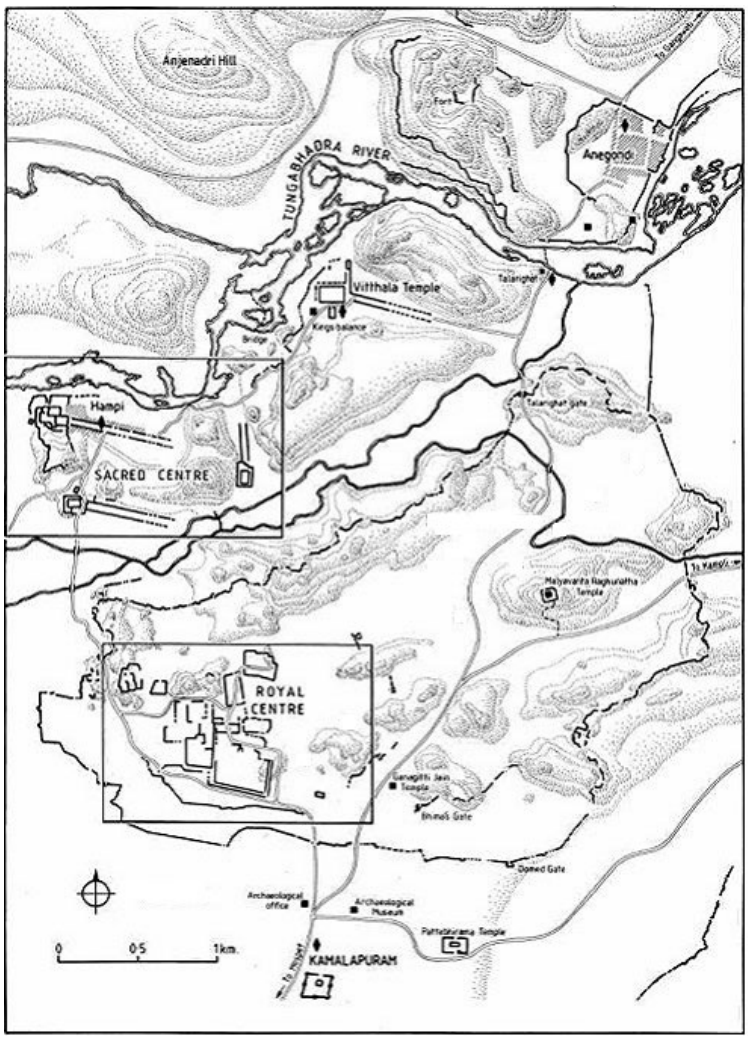

Figure 12. Vijayanagara City

The destruction of Vijayanagara in 1565 was captured vividly in the account of Robert Sewell (1900): "They slaughtered the people without mercy; broke down the temples and palaces; and wreaked such savage vengeance on the abode of the kings that, with the exception of a few great stone built temples and walls, nothing now remains but a heap of ruins to mark the spot where once the stately buildings stood… They lit huge fires in the magnificently decorated buildings forming the temple of Viṭṭhalaswami near the river, and smashed its exquisite stone sculptures. With fire and sword, crowbars and axes they carried on day after day their work of destruction. Never perhaps in the history of the world has such havoc been wrought so suddenly on so splendid a city; teeming with a wealthy and industrious population in the full plenitude of prosperity one day and on the next seized, pillaged and reduced to ruins amid scenes of savage massacre and horrors beggaring description."

Hampi has a strong association with the Ramayana and the names of many sites in the area bear names mentioned in the epic. These include Rishimukha, Malyavanta hill

and Mātanga hill along with a cave where Sugrīva is said to have kept the jewels of Sītā. The site of Anegundi is associated with the kingdom of Angad, son of Vali. The Anjaneya Parvata, a hill to the west of Anegundi, is the fabled birthplace of Hanumān.

Hampi is also linked with the river goddess Pampā and the legend of her marriage to Lord Virupakṣa or Śiva. Each year, in the month of Caitra (March-April), this marriage is re-enacted, with the priests of Virupakṣa temple devoutly performing every ritual from Phalapūjā (betrothal) to Kalyānotsava (marriage) in the temple.

The Sacred Center of the city lies south of the Tungabhadra River, and it is dominated by four large complexes of the Virupaksha, Kṛṣṇa, Tiruvengalanātha (Acyutarāya) and Viṭṭhala temples. The major temples are either close to cardinality, departing by an average of 10', or are oriented to major features of the sacred landscape.

Further south of the Sacred Center is the Royal Center, which is divided into the public and private realms. The division is achieved by a north-south axis, which passes almost precisely between the king's 100-column audience hall in the east and the queen's large palace in the west. The Rāmacandra temple pierces the axis by connecting the private and the public domains. In the homology of the king and the deity, the king is able to inhere in him the royalty and divinity of Rama.

The Vīrabhadra temple is on the summit of Matanga hill, which is the center of the *vāstu-mandala* and the symbolic source of protection that extended outward from it along radial lines. As viewed from a point midway between the audience hall and the queen's palace, the *shikhara* of the Vīrabhadra lies only 4 minutes of arc (4') from true north. The ceremonial gateway in the corridor west of Rāmacandra temple joined with the summit of Matanga hill departs from true north by 0.6 minutes of arc (0.6') (Malville, 2000).

The orientations of the major axes of the small temples, shrines, and palaces of the urban core are in marked contrast to those. The smaller structures are rotated away from cardinality for the four directions by 17^{o}, suggesting that they were influenced by the position of the rising sun on the morning when it crosses the zenith.

The bazaar streets of the Virupakṣa, Viṭṭhala and Kṛṣṇa temples are set between 13 and 15 degrees south of east. Malville (2000) speculates that there may be some link between these orientations and the rising point of the star Sirius.

7 CONCLUSIONS

Interest in archaeoastronomy and art, as connected to temples and ancient monuments, has increased in India as the country's prosperity has increased. This increase is also owing to the major archaeological discoveries that have been made in the past few decades and the importance of temple tourism.

The principal authority over significant sites is the Indian Archaeological Survey of India (ASI) and its sister institutions that function at the state level as Departments of Archaeology and Museums. In 1976, the Indian Government initiated projects to excavate

three great medieval cities: Fatehpur Sikri in Uttar Pradesh, Champaner in Gujarat, and Vijayanagara in Karnataka, which are UNESCO World Heritage sites. The wealth of discoveries made in these cities is strengthening the movement to expose and preserve other sites in the country. The efforts at excavation, conservation, and research can only be expected to increase. In particular, greater attention will be given to the archaeoastronomical aspects of the monuments.

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9
Visions of the Cosmos: Archaeoastronomy in Ancient India*

1 INTRODUCTION

Archaeoastronomy in India has the benefit of ancient texts that describe cosmological ideas, their basis in astronomy, and their representation in architecture. These texts provide us crucial understanding of the astronomy and cosmology of the historical period.

In the Indian view, the cosmos is seen as being tripartite and recursive (see Kak, 2000a and Kak, 2008 for review and additional references). The universe is viewed as three regions of earth, space, and sky (Dumézil, 1988) which in the human being are mirrored in the physical body, the breath (*prāṇa*), and mind. The processes in the sky, on earth, and within the mind are taken to be connected.

Indian narratives about the cosmos are characterized by the central role of the observer. The cosmos is seen both as *real* and arising out of the *phenomenal* contents of the mind. At a practical level, agreement on the phenomenal contents of many minds is taken to imply real existence, and the question of the nature of the qualities of the objects is raised. The question that is asked in the Indian narrative is: Do these attributes or concepts have a real existence or do they arise from the intuition of the observers?

The examination of this and related questions leads to theories of the cosmos, both at the universal and personal levels, that form part of the philosophical systems of Sāṅkhya and Vaiśeṣika. The Vedic view of India (spanning a long period that goes back to at least 2000 BCE) classifies knowledge in two categories: the higher or unified and the lower or dual. Higher knowledge concerns the perceiving subject (consciousness), whereas the lower knowledge concerns objects. Higher knowledge can be arrived at indirectly through intuition and contemplation on the paradoxes of the outer world. Lower knowledge is analytical and it represents standard science with its many branches. There is a complementarity between the higher and the lower, each being necessary to define the other. This complementarity mirrors the one between mind and matter.

The Vedic thinkers were aware that formal descriptions of the universe lead to logical paradox. The one category transcending all oppositions is *Brahman*. Figure 1 represents this world-view schematically. In this figure, logic is shown as a subset of the capacities of the mind, and likewise models of reality (which are based on logic) do not capture all aspects of the material world. Machines have been grouped together with logic in the figure since they must be constructed according to a logical framework. This figure may be viewed as a representation of the incompleteness of formal systems of knowledge. Vedic ritual is a symbolic retelling of this conception. Notable features of this world view that are relevant here are (Basham, 2004):

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- *An Extremely Old and Large Cyclic Universe:* The Vedic texts speak of an infinite universe with ages of very large time periods, or *yugas*. The recursive Vedic world-view requires that the universe itself go through cycles of creation and destruction. The encyclopedic Purāṇas speak of the universe going through a current cycle of 8.64 billion years, and the period of the largest cycle is stated to be 311 trillion years.

- *An Atomic World:* According to the atomic doctrine of Kaṇāda, there are nine classes of substances: ether, space, and time that are continuous; four elementary substances (or particles) called earth, air, water, and fire that are atomic; and two kinds of mind, one omnipresent (the universal self) and another that is the individual mind.

- *Relativity of Time and Space:* That space and time need not flow at the same rate for different observers is encountered in the late Vedic and Purāṇic stories, and in the Mahābhārata and the Yoga Vāsiṣṭha (Dimmitt and van Buitenen, 1978; Kak, 2008).

- *Many Solar Systems:* Indian mythology assumes an uncountable number of worlds (solar systems) (Dimmitt and van Buitenen, 1978). In Purāṇic texts, the diameter of our own solar system is taken to be about 500 million *yojanas* which is about 7.5 billion kilometers (Kak, 1999; Rao and Kak, 2000).

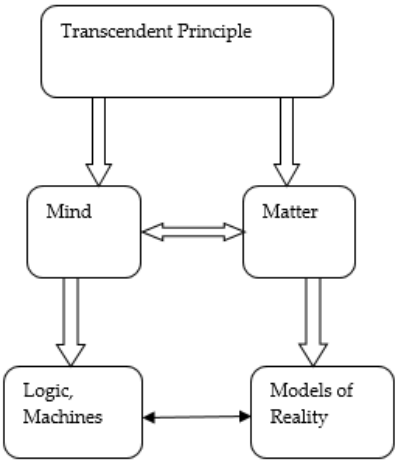

Figure 1. Universe as projection of a transcendent principle

With the above as background to the general ideas regarding the cosmos current in ancient India, we come to the discussion of archaeoastronomy in ancient India. A considerable part of the archaeoastronomy of this period is based on the author's research (see, e.g., Kak, 1992, 1993, 2000a, 2000b, 2005a, 2009). Due to the importance given in Indian culture to

the abstract and the symbolic, many of the archaeoastronomical sites are temples. The king was consecrated at the temple. The consecration served to confirm the king as foremost devotee of the chosen deity, who was taken to be the embodiment of time and the universe (Kak, 2002).

The Indian sacred city has been viewed as a structured *mesocosm*, situated between the microcosm of the individual and the macrocosm of the culturally conceived larger universe (Levy, 1991). Such a city is constructed of spatially connected and recursively layered circles, each of which is sustained by its own culture and performance. Although Levy's city is not very ancient, it is built according to an old tradition (Volwahsen, 2001). The Harappan city of Dholavira (Bisht, 1997) is also recursively structured. Furthermore, temples were taken to be define the meeting ground between the macrocosm and the microcosm, and, therefore, they provide much information on the relationship between astronomy and cosmology.

India's archaeological record has unbroken continuity going back to about 7500 BCE at Mehrgarh (Kenoyer, 1998; Lal, 2002), and it has a rock art tradition, next only to that of Australia and Africa in abundance, that is much older (Pandey, 1993; Bednarik, 2000). Some rock art has been assigned to the Upper Paleolithic period. There is surprising uniformity, both in style and content, in the rock art paintings of the Mesolithic period (10,000 – 2500 BCE) (Wakankar, 1992).

The setting for the hymns of the Ṛgveda, which is India's most ancient literary text, is the area of Sapta Saindhava, the region of north India bounded by the Sindh and the Ganga rivers although regions around this heartland are also mentioned. The Ṛgveda describes the Sarasvati River to be the greatest of the rivers and going from the mountains to the sea. The archaeological record, suggesting that this river had turned dry by1900 BCE, indicates that the Ṛgveda is prior to this epoch.

The Ṛgveda and other early Vedic literature have astronomical references related to the shifting astronomical frame that indicate epochs of the fourth and third millennium BCE which is consistent with the hydrological evidence. The nakshatra lists are found in the Vedas, either directly or listed under their presiding deities, and it one may conclude that their names have not changed. Vedic astronomy used a luni-solar year in which an intercalary month was employed as adjustment with solar year.

The foundation of Vedic cosmology is the notion of *bandhu* (homology or binding between the outer and the inner). It was estimated correctly that the sun and the moon were approximately 108 times their respective diameters from the earth (perhaps from the discovery that the angular size of a pole removed 108 times its height is the same as that of the sun and the moon), and this number was used in sacred architecture. The distance to the sanctum sanctorum of the temple from the gate and the perimeter of the temple were taken to be 54 and 180 units, which are one-half each of 108 and 360 (e.g. Kak, 2005a). Homologies at many levels are at the basis of the idea of recursion, or repetition in scale and time. The astronomical basis of the Vedic ritual was the reconciliation of the lunar and solar years.

2 THE COSMOLOGICAL PLAN OF THE CITY AND THE TEMPLE

According to the *Vāstu Śāstra*, manual of sacred architecture, the structure of the building mirrors the emergence of cosmic order out of primordial chaos through the act of measurement. The universe is symbolically mapped into a square that emphasizes the four cardinal directions. It is represented by the square *vāstupuruṣamaṇḍala*, which in its various forms is the basic plan for the temple, the house, and the city. There exist further elaborations of this plan, some of which are rectangular.

Yantric buildings in the form of *mandalas*, dated to about 2000 BCE, have been discovered in North Afghanistan that belong to a period that corresponds to the late stage of the Harappan tradition (Kak, 2005b, 2010) 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 Harappan system shows that these ideas were widely spread.

Recent studies haves shown that the unit of *dhanus* has been used consistently in India in town planning and architecture for over 4,000 years, going back to the Harappan period. By considering the largest measure which leads to integer dimensions for the various parts of the Harappan age city of Dholavira, which was excavated in the 1990s (Bisht, 1997; Bisht, 1999), it was found that this measure is the same as the *Arthaśāstra* (300 BCE) measure of *dhanus* (bow) that equals 108 *angulas* (fingers) (see Kak, 2009, 2010, for details).

The measure of *dhanus* is seen to apply not only to the Mauryan and Gupta era structures, but even to more recent grid and modular measures in the town planning of Kathmandu Valley. The measures used in ancient India are summarized in the table below.

Measure	angulas	centimeters
angula	1	1.763
vitasti (tāla)	12	21.156
pāda	14	24.682
aratni, P-hasta	24	42.312
C-hasta	28	49.364
F-hasta	54	95.202
daṇḍa	96	169.248
dhanus	108	190.404

The three different *hasta* measures have been called the Prājāpatya (*P-hasta*), commercial (*C-hasta*), and forest (*F-hasta*) by Balasubramaniam (2008), and used variously in different situations. Here we are concerned primarily with *dhanus*, although we will also encounter *pāda* and *aratni*.

With the measure of *dhanus* (D) of 1.9404 m, the dimensions of Mohenjo-Daro's acropolis turn out to be 210 × 105 D; Kalibangan's acropolis turn out to be 126 × 63 D. The dimensions of the lower town of Dholavira are 405 × 324 D; the width of the middle town

is 180 D; and the inner dimensions of the castle are 60 × 48 D (Danino, 2008). The sum of the width and length of the lower town comes to 729 which is astronomically significant since it is 27 × 27, and the width 324 equals the nakshatra year 27 × 12 (Kak, 2009).

The layout of Dholavira is unique in that it comprises of three "towns," which is in accord with Vedic ideas (Bisht, 1997; Bisht, 1999). The feature of recursion in the three towns, or repeating ratios at different scales, is significant. 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, which was also true of Classical India (Bhat, 1995).

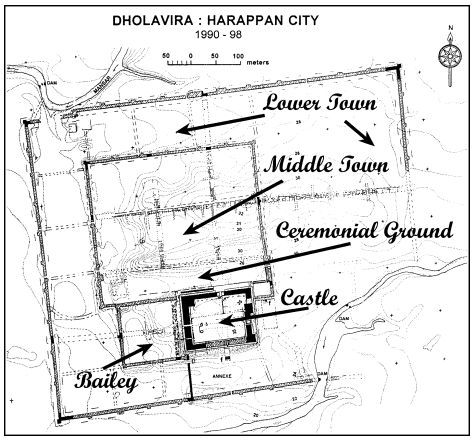

Figure 2. Map of Dholavira (Bisht, 1997)

The Somapura Mahāvihāra of Pāhārpur has dimensions of 280×281 m, which when converted to *dhanus* become nearly 147×147 D, or 49×49 with the units of three times *dhanus*, which would be a natural plan for a *vāstupuruṣamaṇḍala.* The base of the temple was generally in a square grid of 8 or 9 units (64 or 81 squares) in the Bṛhat Saṃhitā (Bhat, 1995), but according to other texts it could range from one to 1024 square divisions. Another text gives special importance to the 7×7 plan.

The Bṛhadīśvara temple (which was completed in 1010 CE), has a sanctum tower of 30.2×30.2×66 and it is within an enclosure of 240×120 m. In *dhanus* units, this amounts to 16×16 D plan in an enclosure of 126×63 D, where the error is less than one percent in the sanctum and almost zero for the enclosure. This indicates that the sanctum used a *vāstupuruṣamaṇḍala* of 64 squares where each square had a length of one-fourth *dhanus*. The dhanus unit also explains the chosen dimensions of Angkor Wat and Prambanan temples in Southeast Asia.

3 MORE ON HARAPPAN AND VEDIC RECORDS

In this section we consider additional evidence from Harappan and Vedic periods. The absence of monumental buildings such as palaces and temples makes the Harappan city strikingly different from its counterparts of Mesopotamia and Egypt, suggesting that the

polity of the Harappan state was de-centralized and based on a balance between the political, the mercantile, and the religious elites. The presence of civic amenities such as wells and drains attests to considerable social equality. The power of the mercantile guilds is clear in the standardization of weights of carefully cut and polished chert cubes that form a combined binary and decimal system.

Mohenjo-Daro and other sites show slight divergence of 1° to 2° clockwise of the axes from the cardinal directions (Wanzke, 1984). It is thought that this might have been due to the orientation of Aldebaran (*Rohiṇī* in Sanskrit) and the Pleiades (*Kṛttikā* in Sanskrit) that rose in the east during 3000 BCE to 2000 BCE at the spring equinox; the word "rohiṇī" literally means rising. Furthermore, the slight difference in the orientations amongst the buildings in Mohenjo-Daro indicates different construction periods using the same traditional sighting points that had shifted in this interval due to precession of the equinoxes (Kenoyer, 1998).

Mohenjo-Daro's astronomy used both the motions of the moon and the sun (Maula, 1984). This is attested by the use of great calendar stones, in the shape of ring, which served to mark the beginning and end of the solar year.

Figure 3. Astronomical seal from the Harappan era (left: picture; right: sketch of same)

The seal of Figure 3 has been viewed by many as representing the Pleiades. The conjunction of this constellation with the sun at the vernal equinox marked the New Year around 2400 BCE. The Pleiades, the wives of the seven sages, are important in Vedic mythology as representing the seven mothers who nurse the war-god Skanda.

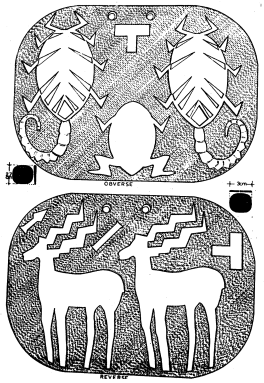

Figure 4. A 3rd millennium seal from Rehman Dheri.

The seal of Figure 4 is taken to represent the opposition of the Orion (Mṛgaśiras, or antelope head) and the Scorpio (Rohiṇī of the southern hemisphere which is 14 nakṣatras from the Rohiṇī of the northern hemisphere) nakshatras. The arrow near the head of one of the antelopes could represent the decapitation of Orion. It is generally accepted that the myth of Prajāpati being killed by Rudra represents the shifting of the beginning of the year away from Orion and it places the astronomical event in the fourth millennium BCE (Kak, 1996, 2000a).

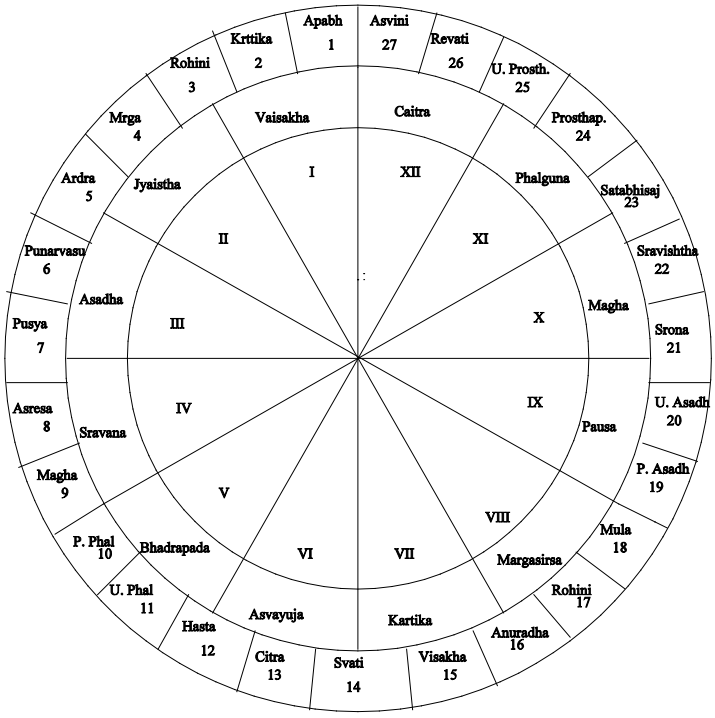

Figure 5. Mapping of the nakṣatras to the solar months

Figure 5 presents the 27 nakṣatras of the Indian astronomy together with the 12 solar segments (*rāśis*). It is significant that the 27 nakshatras contain 24 names together with three which are further subdivided. This indicates that the 24 divisions may have preceded the 27 divisions of the Vedic astronomy.

Fire altars, with astronomical basis, have been found in the third millennium cities of India. Vedic texts describe the design and ritual of the fire altars which were oriented towards the east and whose design, using bricks laid in five layers, coded astronomical knowledge of its times (Kak, 2000a). The best known of the fire altars is the falcon altar of Figure 6. Texts that describe fire altar designs are conservatively dated to the first millennium BCE, but their contents appear to be much older.

Vedic ritual was based on the times for the full and the new moons, the solstices and the equinoxes. There were two years: the ritual year started with the winter solstice (*mahāvrata*), and the civil one started with the spring equinox (*viṣuva*). The passage of the rising of the sun in its northward course from the winter solstice to the summer solstice (*viṣuvant*) was called *gavām ayana*, or the sun's walk. The solar year was divided into two *ayanas*: in the *uttarāyana* the sun travels north; in the *dakṣiṇāyana* it travels south. The movement of the moon was marked by its nightly conjunction with one of the 27 or 28 nakshatras. The Ṛgveda 1.164 also speaks of another tradition of dividing the zodiac into twelve equal parts. It appears that these divisions were called the Ādityas.

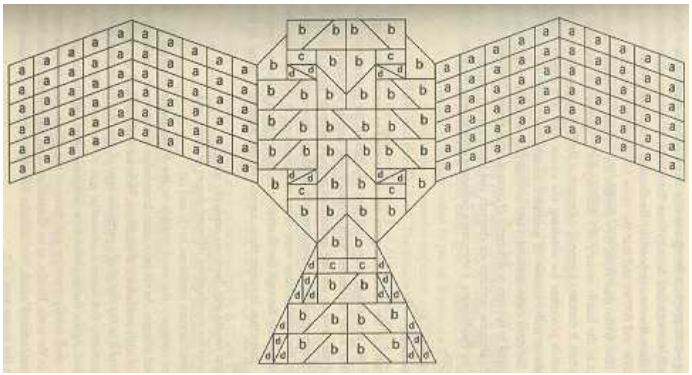

Figure 6. Fire altar designed as falcon

The incommensurability between the lunar and the solar reckonings led to the search for ever-increasing cycles to synchronize the motions of the sun and the moon. This is how the yuga astronomical model was born. In the lunar month, there were separate traditions of counting the beginning of the month by the full-moon day and the new-moon day.

4 NEOLITHIC AND MEGALITHIC SITES

Sites of archaeoastronomical interest include the Neolithic site of Burzahom from Kashmir in North India, and megalithic sites from Brahmagiri and Hanamsagar from Karnataka in South India. The dates for these specific sites are provided in the text. The importance of these sites arises from the fact that they present astronomical knowledge that was most likely outside the literary tradition.

Figure 7. Burzahom sky scene

Burzahom, Kashmir. The Burzahom site is located about 10 km northeast of Srinagar in the Kashmir Valley on a terrace of Late Pleistocene-Holocene deposits. Dated to around 3000 - 1500 BCE, its deep pit dwellings are associated with ground stone axes, bone tools, and gray burnished pottery. A stone slab of 48 cm × 27 cm, obtained from a phase dated to 2125 BCE shows two bright objects in the sky with a hunting scene in the foreground. These have been assumed to be a depiction of a double star system (Rao, 2005).

Brahmagiri, Karnataka. The megalithic stone circles of Brahmagiri in the Chitradurga district of Karnataka in South India, which have been dated to 900 BCE, show astronomical orientations. This site is close to Siddapur where two minor Aśokan rock edicts were found in 1891. Rao (1993) has argued that site lines from the center of a circle to an outer tangent of another circle point to the directions of the sunrise and full moon rise at the time of the solar and lunar solstices and equinox.

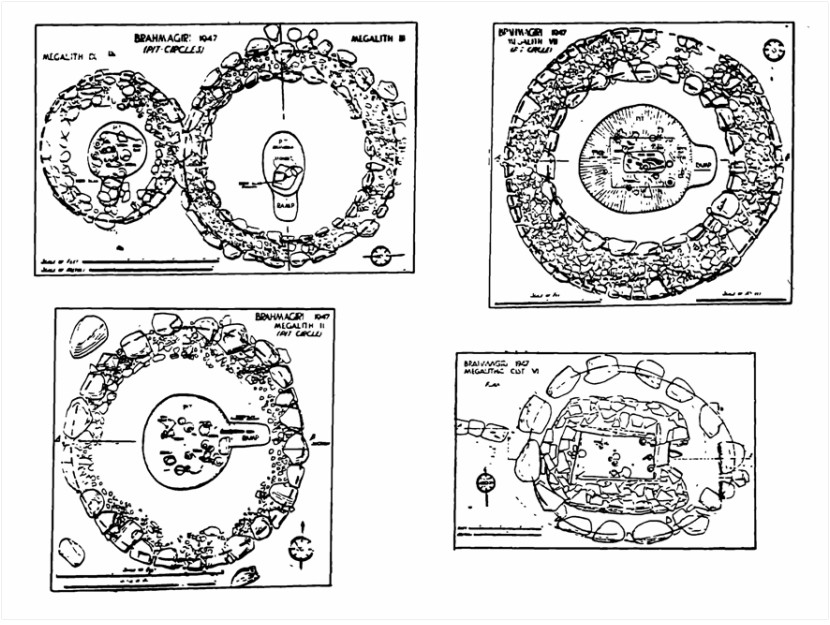

Figure 8. Megalithic stone circles of Brahmagiri

Hanamsagar, Karnataka. Hanamsagar is a megalithic site with stone alignments pointing to

cardinal directions. Since the megalithic period of Karnataka is believed to belong to the first millennium BCE, it may be assumed that this is the period of the site. The site is located on a flat area between hills about 6 km north of the Krishna river at latitude 16º 19′ 18″ and longitude 76º 27′ 10″. The stones, which are smooth granite, are arranged in a square of side that is about 600 meters with 50 rows and 50 column (for a total of 2,500 stones), with a separation between stones of about 12 m. The stones are between 1 to 2.5 m in height with a maximum diameter of 2 to 3 m. The lines are oriented in cardinal directions. There is a squarish central structure known as *chakri katti*.

It has been argued that the directions of summer and winter solstice can be fixed in relation to the outer and the inner squares. Rao (2005) suggests that it could have been used for several other kind of astronomical observations such as use of shadows to tell the time of the day, the prediction of months, seasons and passage of the year.

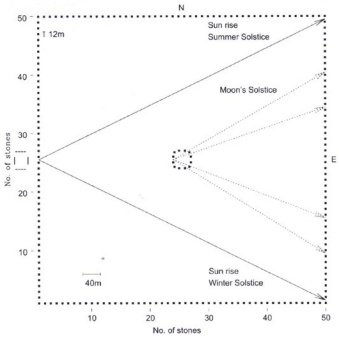

Figure 9. Alignments at Hanamsagar (Rao, 2005)

5 THE SANCHI STUPAS

The Sanchi Stupa, a hemispherical domed structure with a flattened top meant to contain the relics of the Buddha, is believed to have been built by King Aśoka in around 250 BCE; an enlargement to double the size was done by the Śungas (this dynasty ruled between 185 and 73 BCE). It is surrounded by a balustrade that represents the sun's circuit. The Buddha did on full moon day of the lunar month Vaiśākha, and this day is observed as the *Buddha pūrṇimā* day. At full moon the moonrise and sunset are observed in the eastern and western horizons.

It is likely that the astronomical basis of the Stupa was inspired by the Vedic altar that represented the circuit of the sun. It has been shown elsewhere (Millar and Kak, 1999) how this representation of the sun's motion remained common knowledge and it was used in Angkor Wat.

Two further Stupas were built by the Śunga kings and it is believed that they fixed the orientation of the Stupa. G.M. Ballabh and K.D. Abhyankar found that the *Buddha pūrnimā* occurred at Sanchi on April 28, 109 BCE with the sunset and moonrise of the full moon to the east-west orientation of the Stupa (azimuth of the Sun and Moon equal to 285.2 and 105 degrees, respectively, with an altitude of about 1 degree). This also corresponds to the setting

and rising of the Pleiades (Krittikā) and δ Scorpii (Anurādhā) (Rao, 1992).

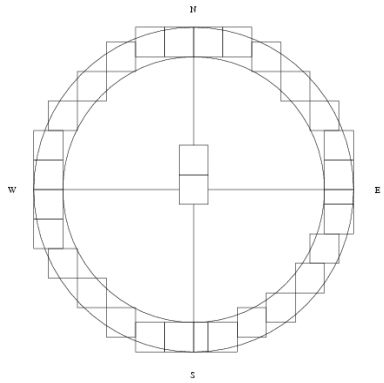

Figure 10. A Vedic fire altar representing the circuit of the sun

There is further astronomical significance to the design of the outer balustrade in the Stupas.

*Great Stupa***.** The outer balustrade has 120 posts arranged in 4 quadrants and they are joined by three rows of 29 horizontal crossbars. Starting with the 30 posts in the first quadrant, 29 crossbars of the second quadrant, 30 posts of the third quadrant, and 29 crossbars of the fourth quadrant, we have a count of 118. Three such rounds correspond to the number of days in the lunar year. Rao (1992) adds that to arrive at an undistorted full circle it would require 108 (i.e. 120-16+4) posts, where the 16 entrance posts have been subtracted and 4 missing posts at each entrance required have been added for reasons of symmetry. We have already mentioned the significance of the count of 108 in Indian astronomy.

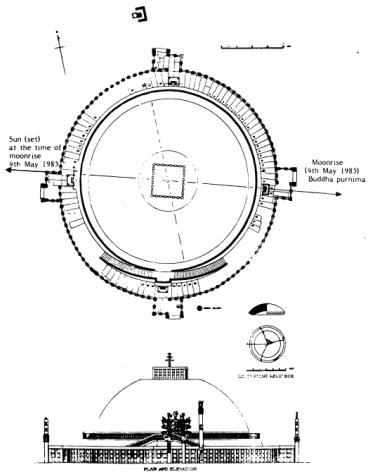

Figure 11. The Sanchi Great Stupa (Rao, 1992)

Rao (1992) speculates that the total number of outer balustrade posts (120) and slabs (115) gives a count of 235 corresponds to the lunations of the Metonic cycle. The *harmika* balustrade at the top has 28 posts, which equals the number of *nakṣatras*.

Figure 12. The Sanchi Great Stupa from Eastern Gate

*Stupa 2***.** The count according to Rao (1992) for the posts and the crossbars is also 354, the number of days in the lunar year.

Rao further speculates that the location of Sanchi may have astronomical significance since its latitude is close to the declination of the sun on the summer solstice day.

6 CONCLUDING REMARKS

This paper presents a broad overview to the archaeoastronomy of ancient India. Indian archaeoastronomy provides unique insights into the nature of ancient science and society in India for this region has vast number of texts belonging to different ages. The assumed homologies between the outer and the inner cosmoses meant that the same vocabulary was used to speak of their respective structures. While this becomes an obstacle for those who do not understand the system, it has within it the potential to explain many attitudes in Indian mythology, religious practice, science, and art.

In concluding, there was continuity between the archaeoastronomy of the early period covered in this essay and that of the medieval period where pilgrimage and temple centers mirrored conceptions of the cosmos. Medieval sites of archaeoastronomical significance include Sisupalgarh, Chitrakut, Vijayanagara, Gaya, Konarak, Khajuraho, and the Suryapuja temples in Tamil Nadu (e.g. Malville, 1989; Malville and Gujral, 2000; Malville and Swaminathan, 2005; Singh, 2009). For example, the temple complex of Khajuraho in Madhya Pradesh, built in 9th -12th century CE by the Chandela kings, form three overlapping circles, with centers at the Lakshmana (Viṣṇu), the Javeri (Śiva), and the Duladeva (Śiva) temples. Their deviation from true cardinality is believed to be due to the direction of sunrise on the day of consecration (Singh, 2009). The Lakshmana temple, one of the oldest of the complex, is considered the *axis mundi* of the site and it is oriented to the sunrise on Holi.

The sun temples of Varanasi (Malville, 1985; Singh, 2009) are interesting in that six of these lie along one side of an isosceles triangle with a base of 2.5km. The triangle surrounds the former temple of Madhyameshavara, which was the original center of the city. Pilgrims walking along the triangle are symbolically circumambulating the cosmos.

The subject of the medieval temples forms an important and fascinating chapter in India's

archaeoastronomy that is beyond the scope of this paper.

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10
The Shaman's Abode*

INTRODUCTION

The shaman heals by mask, trance, dance, drum, silence, chant, rhythm, and touch. Some view the shaman's function as somewhat like that of the psychotherapist, where the idea is that certain illness is caused when our familiar reality is overwhelmed by another inner reality (the unconscious) that exists alongside. The therapist heals by offering companionship in shared consciousness by means of a creative dialogue (e.g. Löben Sels, 2020), whereas the shaman does so by the ritual and drama of the performance.

The shaman's view of the mind is as a balance between different polarities such as flow and stagnation, insight and obsession, or light and dark in which the individual with insight has the capacity to change the mix, but the one lacking insight can feel lost. Freedom is central in this view and this is different from the materialistic position where if logic were to be pushed, we are machines and don't have free will.

The shaman's performance is to create an atmosphere that will help the patient get out of despondency and regain agency. The nine rasas (essences) that underlie theatrical encounters as given by Indian aesthetics theory are:

> *śṛṅgāra* (शृङ्गार): romance, love, attraction; *hāsya* (हास्य): laughter, comedy; *raudra* (रौद्र): fury; *kāruṇya* (कारुण्य): compassion; *bībhatsa* (बीभत्स): disgust, aversion; *bhayānaka* (भयानक): terror; *vīra* (वीर): heroism; *adbhuta* (अद्भुत): wonder, amazement; and *śānta* (शान्त): tranquility.

Out of these, the shaman's performance primarily uses *kāruṇya* (compassion) and *bhayānaka* (terror). It is noteworthy that the presiding deity of these two rasas is Yama (Death); the deities of the others rasas are Śiva, Viṣṇu, Indra, and Brahmā. Compassion helps the shaman establish an empathic bond with the patient and this is achieved through the shaman's own apparent suffering, whereas terror forces the subject to awaken from the *statis* of the pathological condition.

This happens in the domain of consciousness, which is the unknown frontier of science. This is a subject I have been interested in for a long time, and I've researched it from the perspectives of physics and computation (e.g. Kak, 2021), and the intersection between theory and neuroscience (e.g. Kak, 2002). The brief essay here addresses the origins of the term "shaman" and relates it to the logical framework within which the shaman operates. It also shows that certain concepts from the Vedic tradition related to symbolic death and the process of spiritual rebirth help us understand the rationale of the shaman's healing.

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* Academia.edu (2021)

SHAMAN'S PUJA

Let me begin with a personal story about the time we lived in Anantnag, a large town in South Kashmir. I was twelve or so and being difficult as boys of that age are wont to be my parents were concerned. It wasn't anything significant: perhaps I was keeping up nights reading, or perhaps I was not eating well. My parents brought it up with the pandit, Lambodara Guruji (in Kashmiri, *Lambudar Gor*), who made regular rounds about once a month, and it was decided that he would perform a *śamana* puja (in Sanskrit शमन).

I was amused for I had some idea what this might mean for we had come to Anantnag after living in Leh, a place associated with esoteric ritual in which the shaman (*lhaba* for male and *lhamo* for female) goes into trance and slipping into the spirit world gets possessed by the invoked spirit. Even before Ladakh, when we lived in the hills of Jammu, we heard stories of possession and exorcism by shamanic healers.

In Leh, I had seen masked dances and was fascinated by the *dungchen*, the long trumpet-horn with an extraordinarily deep sound that has been compared to the singing of elephants. I knew this music and dance, drums and bells, were used to invoke spirits, but before things got truly scary at the Royal Palace up the hill where free public performances were staged, I would run off home.

Kashmir has its own unique tradition of "mad" or crazy saints and we had heard of the encounters my parents had with two famed saints named Kashkak and Nandabab, who spoke in riddles. In Kashmiri, the "mad" saints are called "*mott*", which is almost definitely the tadbhava of the Sanskrit "*matta*", meaning crazy, intoxicated, or simply mad. In my mind, the shaman was simply a kind of *mott*.

On the appointed day, Guruji arrived with his paraphernalia. He was a small man, perhaps in late fifties or early sixties, with an open smile. Having observed him many times officiating at pujas, I wasn't sure if he knew Sanskrit well for he would begin with a line clearly spoken and then slur through the chant in a manner that made it hard to determine what he was saying. He was in his usual attire of grey pheran and narrow pajamas. After he prepared the corner of the room where the ceremony was to be done and spread out his implements and other materials including a pot with water and a lamp, he asked for me to be brought in.

Pretending that the entire show hurt my feelings, I refused to go in for a while. Finally, my mother pleaded with me and taking me by the arm, sat me before the Guruji. My little sisters and brother were watching with great amusement and broad smiles, happy that it was me and not them on the hot seat.

The shaman began with his incantation "*sham, sham kare, dushman gale ...*" as the ceremony began. Lighting a smoky lamp, chanting non-stop, he worked himself up into quite a performance while I observed the entire process with detachment and amusement.

I have a hazy recollection of the details, but at long last, it was over. He sprinkled water over my face and declared that I was cured of my wayward ways. My siblings had had

the greatest time and they teased me about the thing for weeks.

Was the *śamana* puja I was a part of a mock-trance to arouse awe, or was it a performance just to please my parents? We do know that various kinds of *śamana* puja are done to get relief from the malefic effects of astrological signs. The *karga puja* of the Tamang shamans in Nepal has been used for treating "major indigenous categories of mental illness, that is, soul loss and spirit possession, when they occur simultaneously in a patient." (Peters, 1995) The term that is used for the shaman in Nepal is "jhākri", and it is practiced by many ethnic groups.

Jhakri, a Nepalese shaman (from Independent, Jan 3, 2020)

A variety of performances that include trances, drums, dance, and puja are used by the shaman in various parts of India (Rahmann, 1959; Sidky, 2009). The details of the actual performance vary and depend, no doubt, on the cultural milieu, but there is certain commonality whose basis is universal human experience and is not to be seen as resulting from cultural diffusion.

SHAMANS OF SIBERIA

According to scholars, the word shaman is from the Tungusic word *šaman*, meaning "one who knows". The Tungusic people are native to Siberia and northeast Asia. Turkic, Mongolian and Tungusic languages have been viewed by some scholars as belonging to one family and others have even added Korean and Japanese to this group. The earliest records in the Turkic languages go only to the eighth century, and the Tungusic language was assimilated into the Turkic Sakha language by the seventeenth century. A substantial part of the Sakha people still practices Tengrism (the religion of Chinggis Khan whereTengri is a sky deity) and traditional Shamanism.

A Siberian shaman as pictured by Witsen (1692)

The word “shaman” came to Europe in the late 17th century through the account of the Dutch traveler Nicolaes Witsen reporting on his journeys among the native people of Siberia in his book *Noord en Oost Tatarye* (1692).

Some have suggested that the Sanskrit word *śramaṇa*, for Vedic or Buddhist ascetic, could be the ultimate origin of the Tungusic word since Buddhism did penetrate into the Tungusic regions in early times (Eliade, 2004). This proposal has not found scholarly acceptance as the shaman is not an ascetic and his or her role very different from that of the Buddhist priest. I concur with the view that there is no strong evidence in favor of this derivation.

A shaman hammers his drum in Tuva Republic, in southern Siberia (Chapple, 2016)

My Sakha (Yakut) informant, Svetlana Koltovskaia, has this to say about shamans in the federal Russian Republic of Sakha:

> Sakha (Yakut) people do not use the word “shaman” in their language. We have both female and male shamans. Male shaman is called *oyuun* (ойуун) and female shaman is called *udagan* (удаган). The word's etymology is still not known. Some researchers believe that it comes

from the word "*oy*" which means "jump" for Sakha shamans jump during their ritual which symbolizes their leaving the "middle" world to go to the spirit world.

In Sakha, White shamans are called *aiyy oyuuna* (айыы ойууна). They do not have to wear a special outfit to do their ritual, and they only deal with good spirits. They are sort of regular people, and they have their own community and practice their thing to these days.

Dark shamans are called *abaahy ayuuna* (абааһы ойууна). They serve as mediators between people and evil spirits. There are many types of dark shamans with different status.

The fact that the word "shaman" of the Tungusic people, who are now largely assimilated into the Sakha, is no longer in use indicates that it was most likely a borrowed term.

My Sakha informant, Svetlana Koltovskaia

The scholar Sergei Filatov has stated: "Shamanism was the basic form of religiosity among Yakuts before 1917… According to ancient beliefs, the first Yakuts - Sakha Saaryn Toon and Saby Vaai Khotun - were gods who had come down to Earth from the Highest Heaven with the great mission to create the Sakha nation. The Yakuts also had several beliefs which contemporary neopagans have interpreted as monotheism, including the belief in a supreme god, the Sun (fire), *Aiyy* (Tengri), which has its roots in pan-Turkic religious myth. However, in everyday religious practice little attention was paid to this supreme god." (Filatov, 2000)

Sakha belongs to the Northern group of the Siberian branch of the Turkic language family. The lexicon of Sakha consists of native Turkic words, but it has many borrowings from the surrounding Mongolic and Tungusic languages, numerous loan-words from Russian, as well as words of unknown origin. (Forsyth, 1994; Pakendorf and Novgorodov, 2009).

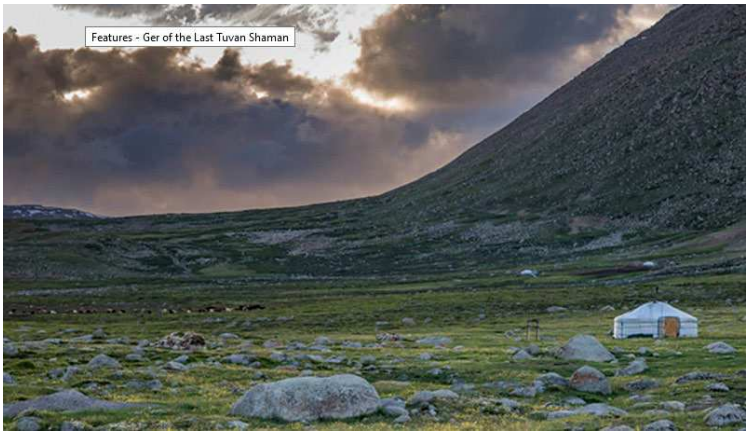
The ancient cultural interaction between India and northern Asia is attested by the presence not only of Buddhism, which is well documented, but also the Vedic tradition as in the worship of Śiva (Kak, 2021a). Sanskritic languages were established in Central Asia for a long time (Kak, 2020). Some have even proposed a Sanskrit etymology for Tengri as "*taṅgiri*" तङ्गिरि, expanding mountain. Goddess Umai is wife of Sky God Tengri. Kuk-Tengri (Blue Sky) and Goddess Umai have parallels with the blue-throated Śiva and Goddess Umā.

A consequence of the long interaction is the penetration of Sanskrit vocabulary into Mongolian. Some examples of Sanskrit loan words in Mongolian are listed in Table 1.

Table 1. Some Sanskrit loan words in Mongolian

Sanskrit	**Mongolian**
Vinaya	Vinai
Śāsana	Śasin
Vajra	Včir
Mahārāja	Mharača
Ādya	Adya (Sunday, Sun)
Somya	Sumya (Monday, Moon)
Aṅgāraka	Angaraq (Tuesday, Mars)
Saṃsāra	Sansar (space)
Abhyāsa	Avyas (talent)
Puṇya	Buyan (good deeds)
Kṣaṇa	Agshin (instant)
Dvīpa	Tiv (continent)
Graha	Garig (planet)
Gṛha	Ger (house)
Jātaka	Tsadig (tales, stories)
Śloka	Shuleg (poems, verses)
Pragātha	Badag (strophe)
Rasāyana	Arshan (nectar)
Ārya	Arya
Āditya	Adya
Vajrāvalī	Ochirbal
Dharma	Darma
Candra	Zandra
Ratna	Radna
Utpala	

These are words that relate to important concepts related to ritual, geography, and astronomy and, therefore, it is possible that other concepts could have similarly penetrated the Turko-Mongol-Tungusic worlds.



The shaman's ger in Mongolia (Baxendale, 2014)

With this as background, we now propose the Sanskrit word *śamana = shaman* as the likely origin of the Tungusic *šaman.* Note that this is very different from the word *śramaṇa* that scholars debated for a long time and eventually dismissed. Whereas śramaṇa is from *śram-,* "to exert" or "to perform work or austerities", *śamana* is from *śam-,* "to appease", "to kill", or "make tranquil".

Also, note that *śamanaḥ = yamaḥ = Death.*

शमन a. (-नी f.) N. of Yama, the god of death

Śamana m. name of Yama-
śāman शामन् n. appeasing, conciliation.
śāmanaḥ शामनः N. of Yama. –नम्; killing, slaughter; tranquility, peace; end; sedation.

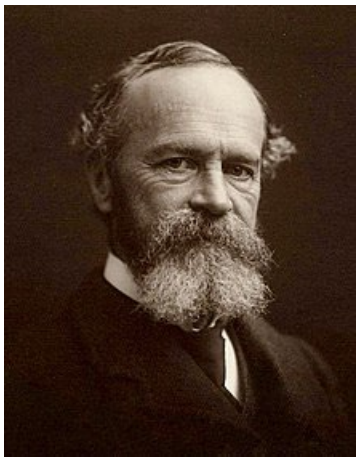
In the above proposal for the origin of the term "shaman", the idea of death is significant. The Vedic tradition claims that healing is achieved by symbolic death associated with *tapas*, heat, generated by the ritual. Maitri Upaniṣad 4.3 notes: "Without the practice of tapas, there is no success in [attaining] the knowledge of the ātman," i.e. self-knowledge.

Note, that the *yajñá*, sacrifice, is ritual where one ceases to be who one was and is born again (Kak, 2007). The sacrificer, seen as equivalent with Prajāpati and the sacrifice, generates himself as embryo from himself in a state of tapas, thus achieving spiritual rebirth (e.g. Taittirīya Saṃhitā 3.1.1.1). The shaman's exertions may be seen within the complex of sacrifice described by Vedic ṛṣis.

The healer's task is to make the patient "whole" again. The shaman takes the broken patient and mends his inner world through his intervention. This recalls the Japanese art of Kintsugi in which broken pottery shards are joined together with gold, embracing flaws and imperfections, that creates a stronger and more beautiful piece of art. "In today's language, while unconscious suffering indeed leads to feeling 'broken', conscious suffering can render us feeling 'whole'" (Löben Sels, 2020).

The sense of being healed is the sense of being born again and been made whole. The shaman, in his or her life, must have had a deep experience of dying and out of that experience gained this ability to slip in and out of non-being. The shaman's wisdom comes from the encounter with the non-being. The shaman has to have been twice-born.

William James, in his book *The Varieties of Religious Experience* drew a contrast between what he called "once born" and the "twice born" people. He described Tolstoy's suffering and subsequent transformation thus: "The process is one of redemption, not of mere reversion to natural health, and the sufferer, when saved, is saved by what seems to him a second birth, a deeper kind of conscious being than he could enjoy before." (James, 1982)



Willam James (1842 – 1910)

The death and the rebirth of the person while alive is the familiar spiritual birth described in Vedic texts. The initiatory Upanayana rite was the way to secret knowledge of the self. Śatapatha Brāhmaṇa 11.5.4.16 notes that "he who enters on a term of studentship becomes an embryo." Atharvaveda 11.5.3 says: "When the teacher receives the brahmacārin as a disciple, he places him [symbolically] as a fetus inside. He carries him for three nights in his belly." These three nights find resonance in the story of Yama as teacher that's given in the next section.

DEATH AS TEACHER

The Vedic tradition sees two polar manifestations of the spirit: calm and fearsome. From the perspective of consciousness, they correspond to light and heat, and are represented in the forms of Śiva and Rudra (Kak, 2021b). In the understanding of change and process, they are manifested as the goddesses Sarasvatī and Lakṣmī (calm) and Durgā and Kālī (fearsome).

Śiva in his manifestations is Śaṅkara (śaṃ-kara, one creates auspiciousness) and Śaṃbhu (śaṃ-bhu, one who becomes auspiciousness) as well as Bhairava (frightful) that represent fullness and emptiness. The dance of Śiva is an ongoing movement through these manifestations.

The Vedic way is about self-knowledge through different forms of Yoga. If the yogic sādhanā is mainly related to devotion and ritual, it is the orthodox way. If it about exploring the very nature of one's consciousness, then it is called Tantra. Within Tantra itself, if the sādhanā is normative, it is called the right-hand path; if, on the other hand, it follows the domain of danger and ways of overcoming fear, it is the left-hand way.

The most fearsome teacher is Death itself. It is the dual of life (*Yama* in Sanskrit actually means "dual") and in many ways, education and creative insight depend on moving away from the personal to the universal (in which the individual self doesn't exist).

The Kaṭha Upaniṣad has the electrifying story of one Vājaśravasa who is to give away his valued possessions to the priests in a certain ritual. His young son Naciketā (Sanskrit: नचिकेता) is ashamed to see that the father is giving away useless cows and animals by sticking to the letter of the ritual and not its spirit. He asks his father if he, the son, will also be given

away. The father ignores him two times, but angered by his son's repeating his impudent question a third time he says in anger that he is given to Death (Yama).

Naciketā doesn't want his father's words to be false so he visits the abode of Yama, who is away which makes Naciketā wait for three nights (the significance of three nights in initiatory ritual has already been mentioned). When Yama arrives, he offers Naciketā three wishes to atone for the dishonor to him as guest.

Naciketā's first wish is that Yama should discharge him from the abode of death, back to his family, and that his father be calm, well-disposed and same as he was before. His second wish is to know the specific fire ritual that enables a human being to secure heaven.

His third wish is to know "what happens after a person dies? Does one continue to exist in another form?" Yama tries to dissuade him from asking this question but eventually gives instruction about the nature of life and death and how the Self (Atman) is the same for all sentient beings and also instructs him in the nature of the mind and subjective consciousness and how doing Yoga one can go beyond fear and obtain bliss and know the meaning of one's personal life.

The parable of Naciketā and Yama is that the deepest learning is obtained when one confronts death, even if only symbolically.

Yama in ritual or self-knowledge works as flow that counters the pathological static states.

The centrality of Yama as teacher in this very significant Upaniṣad and the fact that Yama is the presiding deity of two rasas that are significant in the Shamanic performance indicates that such ritual was already present in India in ancient times. We can suppose that this ritual complemented the orthodox ritual just as is true for the present times.

THE SHAMAN WITHIN

Living life wisely is to live with the Yama or Shaman who resides within each one of us. Suffering is a consequence of attachment (of being too much within one's own body) and Yama is the guide who helps us with the counter impulse of detachment and sacrifice. Life is not only about wanting and possessing: it is a dance between the opposites of taking and then giving it up, a movement between being and non-being. Doing this dance takes one to deeper levels of experience carried ultimately to the point of illumination within each person.

The drama of the shaman's performance is to free the individual from the shackles placed on the imagination by his or her own mind. One needs to go for help to the outer shaman only when one is alienated from the shaman within. The shaman's performance is universal in its attempt to lead the subject to one's atavistic fears and impulses so as to overcome them but the manner in which it is expressed depends on the culture.

Shamanism appears to have been practiced in all corners of the ancient world, but it is likely the origin of the word is the Sanskrit *śamana* (shaman) which was carried into northern Asia along with many other cultural terms that are listed in this essay.

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11
Uttarakuru and the Slavs*

INTRODUCTION

In Sanskrit texts, ancient India's northern lands beyond the Himalayas are called Uttarakuru (in the east) and Uttaramadra (in the west). These lands do not figure in the earliest Vedic books. The name "Kuru" is found just once in Ṛgveda 10.33.4 where there is a reference to Kuruśravaṇa Trasadasyu, who is a king of the Pūrus. The Kurus are mentioned in late books such as the Aitareya Brāhmaṇa and the Mahābhārata. Later another name Śākadvīpa is used for this entire region.

The Purāṇas speak of four regions of Jambudvīpa, Ketumāla, Bhadrāśva and Uttarakuru. Jambudvīpa is India proper, Ketumāla represents the Oxus region, Bhadrāśva is the Jaxartes region and Uttarakuru denotes the country beyond it. In the Mahābhārata, Uttarakuru is paired with Dakṣiṇakuru to the south of the Himalayas. The distance between these regions can be estimated from the military campaign of Arjuna described in the Sabhāparvan सभापर्व. After crossing the White Mountain (Śvetaparvata), Arjuna marches through Haimavata and reaches the Mānasarovara Lake in the country of the Hāṭakas, dominated by the Gandharvas. From there he enters the region called Harivarṣa, beyond which lies Uttarakuru. Clearly, by this time the name Uttarakuru had subsumed Uttaramadra. As described in the Ṛgveda, the region of Dṛṣadvatī, Sarasvatī and Āpayā was where the Bharata kings ruled. In the Āprī hymns, Sarasvatī River is Bhāratī, the glory of the Bhāratas. This region became known as Kurukṣetra later, when the Kurus became its rulers.

In the Aitareya Brāhmaṇa (8. 14), it is stated that the Uttarakurus consecrate their kings by Vedic rites. Later, in the same text (8. 23), Vāsiṣṭha Sātyahavya anoints Jānaṃtapi Atyarāti according to the ritual of Aindra Mahābhiṣeka, who, in consequence goes out to conquer the world.

Some scholars see the Kurus sweep further into Persia and later into Sogdia, Anatolia and beyond. Another section of the Kurus, called Prātipeyas, are known as Bāhlikas since one of the sons of Pratīpa was called Bāhlika, indicating association with Bactria.

A passage in the Bhīṣmaparvan of the Mahābhārata, explains that Śākadvīpa, a land that includes Uttarakuru and Uttaramadra, is organized in classes just like India: "In that region are four countries, Maga, Maśaka, Mānasa and Mandaga. Maga is mainly inhabited by Brāhmīns who love their tasks; in Maśaka there are virtuous Kṣatriyas who are generous; in Mānasa the Vaiśyas are brave, devoted to the wishes of all, bent on dharma and artha; and the Śūdras in Mandaga, for their part, are constantly pious."

In Vāyu Purāṇa 45.116–7, Vāhlīkas, Vatadhanas, Ābhīras, Aparītas, Madras, Pahlavas, Gāndhāras, Yavanas, Sindhus, Sauvīras, Bhadrakas, Śaka are called Kṣatriyas and thus part of Indic people.

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* Itihasa Darpan, vol. 25, 1-2, pp. 59-66, 2020

According to the Sāmba Purāṇa, the Maga Brāhmīns, also called Bhojaka or Śākadvīpīya, came to India from Śākadvīpa.

EXPANSION OF THE VEDIC PEOPLE WESTWARDS

The languages and the vocabularies of the Śākadvīpa tell us some about their connections with India, and they also illuminate the history of Sanskrit and Prakrit languages. For this one must check material in Avestan, Pahlavi, Gāndhāri, Sogdian, and Śāka languages.

A Puranic legend provides another important clue. It tells us that Vaivasvata Manu had nine sons, including Ikṣvāku, and a daughter, Iḷā or Ilā. The descendants of Ikṣvāku are members of the Sūryavaṃśī solar dynasty and Rāma of Rāmāyaṇa fame was born in this line. Budha, the son of Candra, and Ilā had a son named Purūravas (also in Ṛgveda 10.95.18). Subsequently, thanks to a boon Ilā became a man named Sudyumna. The descendants of Ilā/Sudyumna are thus called Aila or Candravaṃśī (lunar dynasty). According to Puranic accounts, Purūravas ruled Uttarakuru as part of the Kuru Empire. The famous story of Purūravas falling in love with Urvaśī is found in the Ṛgveda (10.95.1–18) and the Śatapatha Brāhmaṇa (11.5.1).

Purūravas's great-grandson was Yayāti who had five sons: Yadu and Turvasu/Turvaṣa, sons by his wife Devayānī, and Druhyu, Anu and Pūru, sons by his wife Śarmiṣṭhā. The Pūrus ruled around Kurukṣetra, the Anus to their north, the Druhyus to the west, the Yadus to their south, and the Turvasus to the east of the Yadus.

At the end of the Ten-kings (dāśarājña) battle of the Ṛgveda, the Pūrus expand westwards and Anus push outwards into Afghanistan leading to a further northwards push to the Druhyus who went out into Central Asia. The migration of these tribes westward from India is to be found in Vāyu P. 99.11-12, Brahmāṇḍa P. 3.74.11-12, Matsya P. 48.9, Viṣṇu P. 4.17.5, Bhāgavata 9.23.15-16.

Shrikant Talageri has adduced much evidence [1] from the Ṛgveda in support of such movement out of India's western borders. According to him, the Anu are the ancestors of the Iranians and the Druhyu are the ancestors of Greek and European peoples and of the Druids. Ptolemy's Geography refers to Ottorokorai (Uttarakuru) tribe, Ottorokora as a city, and Ottorokoras as a river. Other scholars believe that the Tokhari (Tukharas) are the same as the Rishikas (Ṛṣika), who are mentioned in Sanskrit texts.

LANGUAGE IN THE NORTHERN LANDS

I have written elsewhere on the languages of East Śākadvīpa, that is Khotan and Xinjiang so I will only provide a brief summary here. Many people in this region spoke Sanskritic languages such as Gāndhārī, which has Dardic features that it shares with Kashmiri, and the closely related Khotanese Saka.

Khotanese kings were Mahāyāna Buddhist but we know this sect incorporates Vedic and Tantric systems, with all the devas such as Indra, Śiva, Viṣṇu and Sarasvatī, and just places the Buddha at the head of the system (as in Vidyākara's Treasury). There was also Krishna worship in Khotan and we find the Rāma story in Khotanese language, of which

there is also a Tibetan version.

West Śākadvīpa, that is Bactria and lands beyond, also used Aryan languages. This includes not only Avestan and Pahlavi but also the language of the Kushan Emperor Kanishka in his Rabatak Inscription. Further north, in the vast region with cities like Samarkand and Bukhara, the Sogdian language was most influential.

I am in the middle of compiling a dictionary of Sogdian words and here're some randomly chosen words from the list:

[Sogdian]: [Sanskrit]
1=ēw: one ईव, एक
ēw-žwānē: one life ईव-जीवनी
3 əərē: three त्रि
12 = δəwātəs: dawātas, twelve द्वादस, द्वादश
100 stu: a hundred शत
āγət: āgat, to bring आगत
āγund- āγust: to cover, आगुन्द, Hindi गूंधना
āstənē: initial, first आस्तीन
ātar-: fire आतर, आथर्व
āwart-: to turn hither आवर्त
əβžirēnē: made of diamonds; अवज्रिनि from वज्र
əδu (əδəw): two द्वि
āfrīn- āfrīt: bless आप्री
əftəmi: first, first of all, prathami, प्रथमी
əftəmīk: first, 1st prathamik, प्रथमिक
ēžəndē: worthy एजंदे. यजत yajanta, यजन्त
əktānē: sin akartva अकर्त्व
əktəspās: obliging अक्त
əktē, əktč: done कर्त्य
əkətyā: act, deed कर्त्य
əkut, plur. əkutīšt: dog अकुत (कुत्ता)
ambēr-: to fill अम्भर
anwēž: to gather अन्वेष
anxər: star, constellation नक्षत्र
anxərkəsē: astrologer अंखरकसी
anxəstē: goaded ankushta, अंकुश
aryān wēžən: The Aryan Expanse आर्यन विशान

əstəkanǰəl: of bone अष्टिकञ्जर
əškamb: world (~ loka) अस्कम्भ
šm'r-(ə)šmārt: to think स्मर स्मृति
əšmārā: thought अस्मार
ōsuγd: to be purified ओषधि
xšēθ: ruler क्षत्र
ēžən: worthy यजन
βəγpəšē: son of gods bhagapashi भगपुत्र
βəγistān: place of gods भगिस्थान
čəxr: wheel चक्र
δβər: door, gate दबर द्वार
δβyš δβēš: harm दबीश द्वेश
δβyšny δβēšenē: harmful द्वेशनी
δrjy'wr žyāwər: heart हृदयवार
friy: dear प्रिय
frītāt: love, charity प्रियतात
frī-rəwān: soul-loving, प्रिय उर्वन
fəsāč-: to teach प्रशास्ति
γandāk: bad, foul गन्द
γandā(k)kərē: evil-doer गन्दकरी
γər: mountain गर. गिरि
γərāmē: wealth गरामि, गरिमा
γərān: heavy गराम, गुरु
žənā: knowledge जेना, ज्ञान
žəw-: to live जिव
žəwān fem.: life जीवन
žūkyā: (good) health सुख्य. सुख
žwandē: living जीवन्त
kōtər: family कोतर (Skt gotra) गोत्र
kutsār: where(to)
kōtī: (zillion) कोटि
zrγwny zərγōnē, fem. zərγōnəč: green हरिगुणी
zrw'βγ zərwā-βəγ: God Zurwān, ज़ुर्वा-भग
smyrγr səmīrγər: Mt. Sumeru सुमेरु
stβt stəβd: hard, harsh, fierce स्तब्ध

stryc, plur. stryšt strīč, strīšt: female, woman स्त्री

swβtγwš suβd-γōš: whose ears are pierced, having pierced ears सुविद्ध => सुब्ध ; श्रोत्र => गोश;=> सुब्ध-गोश

rwxšn'γrδmn ruxšnāγərəδmən fem.: the Light Paradise रुच-सान गर्तम् => रुखसान गर्तमन

sm'n smān: heaven अश्मन, आसमान

sm'nxšyδ smānxšēδ: Ruler of Heaven, Rex Honoris अश्मन-क्षत्र

smwtr səmutr: ocean (Skt samudra) समुद्र

nənə-δβāmbən: Goddess Nana नना देवी अम्बा

Nanā, ननā, is the name for goddess (as in Ṛgveda 9.112.3 कारुरहं ततो भिषगुपलप्रक्षिणी नना), speech (Vāc), and daughter in Sanskrit.

Some interesting words. Given that the Sogdian words have much connections with Sanskrit and Prakrit, here is the hidden history of a few words.

Farsi Khorasan (or Khurasan) خراسان (Xorâsân), which we know from earlier usages in the area to be from earlier خوراسان (xwarâsân), from Middle Persian hwlʾsʾn' (xwarāsān, literally "sunrise; east"). The Sassanian and post-Islamic Persian name for the region of Parthia located in north east of Iran, sometimes covering also parts of Central Asia and Afghanistan is Khorasan.

We know that Sanskrit svar स्वर् means the "sun" and the "heaven of light" as early as in the Ṛgveda. The word svara स्वर literally means "going" and it normally stands for sound or voice and it also means a vowel, the number seven, an accent and so on. In Avesta, the Sanskrit svar became modified by sound change to xwara or even khar, as we see in that last name. Thus svar-sthāna, स्वरस्थान, the place of the sun (or sunrise) became in the Avestan pronunciation of the word as खोरसान and खुरासान.

The word हिम hima means cold and we see hemaka stands for gold. We have another word for beings called यक्ष Yakṣa who live in cold climates. The chief Yakṣa is Kubera कुबेर, the god of wealth; he is represented as having three legs and eight teeth. There are two tadbhava forms of yakṣa: yakh (cold) and yaccha (Kashmiri for Yakṣa, just like Lakṣmī in its tadbhav forms become either Lakhmi or Lacchmi). From there to Avestan (aēxa-, "frost, ice"), Persian یخ (yakh).

Farsi Khurshed = Sun. History of its derivation: Sanskrit svara स्वर (Sun) => hvare (Avestan) kṣaita क्षैत(m. radiant, prince) => xshaeta hvarexshaêtahe [hvare-xshaêta]= radiant sun in Avestan => Khwarshēd (in Middle Persian) => Khurshēd/Khorshīd in Modern Persian.

THE SLAVS

The Slavs reside in all directions to the west of Uttarakuru. The East Slavs are those living in Belarus, Russia, and Ukraine, the West Slavs live in Czechia, Poland, and Slovakia, and the South Slavs live in Bosnia & Herzegovina, Bulgaria, Croatia, Macedonia, Montenegro, Serbia, and Slovenia. According to many reports, the youth in the Slavic nations are turning to "pagan" traditions to seek meaning in their lives and to connect to their ancient religion.

A formal revival of Slavic deities, under the name Rodnovery (invoking Rod, a name for God) is underway in Eastern Europe. But it is not only the Slavs who wish to connect to the past and it includes the Mari, who speak a Finno-Ugric language and other people.

Many followers of Rodnoverie prefer the name Vedic Faith (*vedizm, vedicheskaia vera*) [2]. Mirroring Sanātana Dharma, they speak of spirituality (*dukhovnost'*), wisdom (*mudrost'*), or philosophy and worldview (*mirovozzrenie*).

Not many know that Ukraine and Russia were Christianized rather violently only about a thousand years ago, and the process in the countryside was completed only in the seventeenth century.

In the 12th-century, the German missionary Helmold of Bosau wrote in *Chronica Slavorum* that the Slavs believed in an impersonal God, quite like the Vedic Brahman. Around the same time, the Kiev Chronicle (*Povest vremennykh let*) speaks of the following principal Slavic deities Perun, Volos, Khors, Dazhbog, Stribog, Simargl and Mokosh [4]. The generic name for God in the Slavic world is Bog, or भग.

Other ancient deities, whose worship was widespread and known from even earlier documents, are Svarog and the trinity of Triglav (like Trimūrti) as a fusion of Svarog, Perun, and Dazhbog. There is also another four-headed divinity (like Brahmā) named Svetovid and a deity named Živa.

Scholars know that Slavic Gods are no other than Vedic Gods, although they see the historical relationship between the two variously. The connection shouldn't be surprising since the Slavs (who include the Śaka or the Scythians) lived just northwest of India in the wide expanse of Central Asia and beyond.

Although the earliest Vedic texts do not appear to know a region beyond the Sapta Sindhu, by the time of the later texts Uttarakuru was recognized as a frontier land of the Vedic world. Later texts that were most likely written in 2nd millennium BCE do make a reference to this region. The Rājasūya Sacrifice performed by King Yudhiṣṭhira was attended by kings from Uttarakuru.

The plains of Central Asia have had many shifts in demography and we are informed by the recently excavated Rabatak Inscription of Emperor Kanishka, that the language of his ancestors in Central Asia was what he calls Aryan (or Sanskritic), even though the later Chinese chronicles call them as the Yuezhi, scholars now accept the Kushans were a Śaka tribe.

The astronomical references in the earliest Vedic texts take us to at least the 3rd millennium BCE [5]. At the same time, new research indicates that European languages are

rather late arrivals in Europe, and may be as late as 2500 BCE.

It becomes important, therefore, to note the genetic relationship between the Vedic tradition and the remembered Slavic gods. Here I am only going to touch upon the deities mentioned in the Kiev Chronicle.

Rod, the Faith, from "rodno" meaning "of birth" (родит — to birth), which means the native (natal/birth) faith. A more esoteric connection is to Rudra, which is from the root *rud* रुद् meaning "to cry" or "lament" (as the new-born baby does) that alludes to how normal consciousness is of helplessness unless countered by grace from Śiva.

Bog, Skt. Bhaga भग or भगवान्

Perun, Skt. Parjanya पर्जन्य

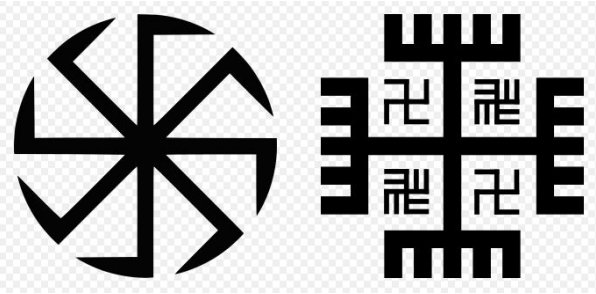
RV 5.83

áchā vada tavásaṃ gīrbhír ābhí stuhí parjányaṃ námasâ vivāsa
kánikradad vṛṣabhó jīrádānū réto dadhāty óṣadhīṣu gárbham

I address the mighty Parjanya and praise him with this adoration and with reverence
He is the thunderer, the showerer, the bountiful, who germinates the plants with rain

Parjanya, is the aspect of Indra associated with the transforming agency in the mind's inner space that makes it possible to generate new ideas.

Two important symbols of the Slavs are kolovrat, the wheel (चक्रवत्) and swastika, sun symbol (स्वस्तिक).



Symbols: kolovrat, the wheel (चक्रवत्) and swastika, sun symbol (स्वस्तिक)

Volos, Skt. Vala, वल. Somewhat like Vṛtra, Vala is a stone cave, split by Indra (strengthened by Soma, identified with Brhaspati in 4.50 and 10.68 or Trita in 1.52, aided by the Angirasas in 2.11), to liberate the cows and Ushas, hidden there by the Panis.

Khors, Sun, Skt. Surya, सूर्य, स्वर् and from the latter comes Persian Khor as in Khorshid, or Khar as name of lord.

Dazhbog, Skt. दक्ष-भग

Stribog, Wind-god, Skt. स्तृत-भग

Simargl, Skt. श्येन मृग, śyena-bird, from which comes Persian Simurgh سیمرغ.

For those who know Vedic ritual, the great altar was built in the form of the falcon,

śyena.
Mokosh, Goddess, Skt. मोक्ष
Svarog, Goddess, Skt. स्वर्ग

It seems reasonable to see the Slavic religion as part of the Vedic tradition, to be viewed here as a universal way of spiritual knowledge, or Sanātana Dharma सनातन धर्म.

Christianity was violently imposed on the Slavs, but it still had to make some concessions to people who remained devoted to old practices. In Christianity ritual movement is *withershins*, that is against the movement of the sun as was true of Roman religion, but eventually Slavic Christianity was forced to adopt *sunwise* movement (that is clockwise, प्रदक्षिणा, which is the way of the Vedic tradition). Likewise, Slavic festivals are a continuation of their old festivals, that were assimilated into Christianity.

According to Saxo Grammaticus (c. 1160–1220), the Slavic temples displayed three-, four- or many-headed images, which were wooden or carved in stone, or covered in metal, that were decorated with solar symbols. As an even further parallel with India, the temples were built on upraised platforms, on hills, and at the confluences of rivers. The Slavs saw the temples as the houses of gods, *continae*, or kṣiti क्षिति. They were wooden buildings with the god's image in the sanctum sanctorum गर्भगृह.

Ritual banquets were known variously in Russia as bratchina (from brat, भ्रातृ), mol'ba (entreaty, manman मन्मन्) and kanun (religious service, from Greek kanōn, "rule" कानून); in Serbia as slava (glorification, śravas श्रवस्); and in Burlgaria as sobor (assembly, sabhā सभा) and kurban (sacrifice, karman, कर्मन्, or Arabic kurban).

Russia has been the West's great adversary during the last hundred years. First, as Soviet Union — before its collapse in 1991 — it battled Western capitalism throughout the world using the ideology of communism. Now its appeal is to nationalism and support of movements that wish to weaken and break up the European Union.

The Russian tradition is fraught with complexity. Although the Church serves as a convenient institution to rally around, there is a strong undercurrent amongst many Slavs to be reconnected to the ancient Slavic religion. Furthermore, the practiced religion is not easily disentangled from the ancient ways.

The Christianization of the Slavs was a slow process that was resisted for a long time, and eventually Christianity became a largely superficial over-structure which in the words of Church Slavonic vocabulary is a "double faith" (dvoeverie in Russian). Dvoeverie is also used to characterize the revival of Slavic Native Faith (Rodnovery) and Vedism.

The Slavic rulers swore regularly by their god Perun (Skt. Parjanya). The conversion of the Kievan ruler, Vladimir, which marks the major shift in the history of the Slavs, took place in 988 and The Primary Chronicle, compiled about 1111, informs us that after his baptism, Vladimir directed that the idol of Perun "be bound to a horse's tail and pulled from the hill. He appointed twelve men to beat the idol with sticks. While it was being dragged

along the stream to the Dnieper, the unbelievers wept over it." Historically, the popular resistance to Christianity was led by priests, and it persisted for centuries with the Slavs regularly re-embracing their original religion (*relapsi sunt denuo ad paganismus*).

The Germans used both violence and tithing to induce the Slavs to convert. In the 8th century, when the missionary Boniface asked Pope Zachary about Slav serfs working on church lands, he received the reply that "if they pay tribute, they will think the land is theirs. But made to pay tithes they will know who is the lord of the land."

The American historian James Westfall Thompson wrote in 1916 on the conversion of the Baltic Slavs by the German Church. He believed the treatment meted out to the Slavs by the Germans had a parallel in how Spanish America treated Peru in "the spoliation of a weaker people by an avaricious priest class backed up by the sword of a powerful government."

Thompson added [6]: "[The Slavs] accepted Christianity as they accepted German domination, superficially and morosely." There were many revolts by the Slavs against the tyranny of the Germans. But although the Church eventually triumphed, the faith as practiced remained deeply mystical, and quite different from the dogma of the Church. Fyodor Dostoyevsky wrote about the religion of the sadness and suffering of Russia as fundamental to the Russian spirit.

The historian George Richards wrote in 1918 [7]: "[T]he religion of Russia is broader and deeper than the creed, polity, cultus, and precepts of the Church of Russia. The life of the spirit defies definition… It consists, not of temples and sacraments, priests and monks, dogmas and canons, but of moods and motives... and ideals-all welling up from the soul's depth."

He added: "Her literature, art, music, philosophy, religion, theater, and dancing are something intrinsically Russian. Her dominant spirit is not the product of Byzantine Christianity. It is rooted in the Slavic nature, and in oriental mysticism. The remote past with its passions, dreams, fears, and hopes throbs in the living present."

It is recognized by scholars that the main deities listed in the Kiev Chronicle are Vedic deities with some evolution in meaning that somewhat parallels the changes that occurred in India. The linguist Roman Jakobson listed many key Slavic terms and the corresponding Sanskrit and Iranian ones; these are correctly seen as Vedic since there is no evidence that the Slavs ever embraced the Zoroastrian religion.

I have written elsewhere on the major parallels between Slavic and Vedic traditions. Here is some additional information. As in India, divinity for Slavs is nebo (Skt. नभ nabha, sky; Kashmiri nab, sky), and div is a point of light that can be used variously. The generic name of God is bog (Skt bhag भग or भगवान्). Some important Slavic religious notions are faith, vera (Skt. parā, परा, going beyond, which signifies faith), holy and sacred, svet (Skt. śveta श्वेत् for bright), peace and agreement, mir (Skt. maitri मैत्रि) and paradise, rai (Skt. rayi). Some terms in Slavic are closer to Iranian forms of Sanskrit words, but that is to be expected since the Iranians were the immediate neighbors of the Slavs. We see this most strikingly in

the Slavic divinity Simargl, which is clearly close in linguistic terms to the Iranian winged monster, Sīmorg (Skt. Śyena-mṛga, श्येन मृग, falcon bird). But its usage amongst the Slavs as divinity is quite like in the great Vedic Agnicayana fire altar, where it symbolizes time [8].

Apart from the usage of Vedic terms for a variety of philosophical and religious concepts, the Slavic conception of divinity as impersonal is identical to the Vedic. The Slavic religion must be seen as representing a description of the inner space of the mind, which is consistent with its conception as a mystical tradition based on contemplation.

The One Reality in the Vedic religion has an expression in triplicate in various sets of polarities together with the process between the two, as in examples of light, activity, and darkness and God, Goddess, and attributes.

The common Slavic polarities are:

Rod-Rozanica like Skt. Rudra-Rudrāṇī रुद्र-रुद्राणी (Rod, by itself, could also be Ṛta, the Law)

Sud-Sudenica like Skt. Siddha, सिद्ध (Kashmiri sĕd, for Śiva)

Belobog-Chernbog (white god- black god, Skt. bhadra-bhaga and cherun-bhaga, भद्र-भग छेरुन-भग, auspicious and inauspicious gods (Kashmiri cherun छेरुन् means Skt. मलिनित)

Zhibog-Zhiva (Skt. Śivabhaga-Śivā, शिवभग, शिवा)

Khors Dazhbog and Jutrobog. This is Skt. Svar (स्वर् Sun or Light), Dakṣabhag दक्षभग for the Sun and Candrabhag चन्द्रभग for the Moon.

The triplicateness of reality is represented by Triglav, Tribog (Skt. tribhaga, त्रिभग). The three-headed divinity encompassing the three divisions of the universe into heaven, movement, and earth, or past, present, and future, and so on. Triglav is interpreted as the equivalent of Skt. Trimurti.

Svarog (Skt. svarga स्वर्ग) represnting heaven, which is where heroes go.

Svetovid (Skt. Śvetavid, श्वेतविद्, Lord of Light) is viewed as four-headed, with each representing a direction of space. In some traditions, the white northward head is Svarog, the red westward head is Perun, the black southward head is Lada (Earth Goddess), and the green eastward head is Mokosh (Goddess of Waters as Skt. Mokṣa, who is also seen as a form of Aredvi Sura Anahita, or Śurā Sarasvatī); two are male and two female.

Ognebog (Skt. Agnibhaga, अग्निभग, Fire God.) He is equated with Simargl, since the fire ritual took place on the Falcon altar.

The above list represents just some of the symbols of the Vedic system, which the tradition claims is a "science of consciousness". The tradition takes the outside world to be mirrored in the inner space of the mind and it believes that "true knowledge" is possible.

I should also add that the Vedic symbols are also used beyond the Slavic lands to the west, especially in Lithuania.

THE BALTICS

Like the Slavs, the Lithuanians resisted the Northern Crusades for a long time, but eventually the sacred fire (Ugnė, Skt. Agni अग्नि) was extinguished in Eastern Lithuania in 1387 and in Western Lithuania in 1413. These changes affected the nobility the most, and the conservative Lithuanian population secretly worshiped their gods for several centuries more. Lithuanians now call their old religion *Romuva*, a name chosen in honor of the famous Baltic Prussian sanctuary Romuva which was destroyed by Christians. The name Romuva (from the Baltic rām-, 'calm, serene, quiet', which is identical to Skt. Rām राम) goes back to the deepest resonances in Indo-European beliefs.

Baltic culture is properly called the Darna, which means "harmony" as does the word "derme". In this, its meaning is identical to the Sanskrit "Dharma" धर्म. Just as every role in the Vedic world has its dharma, so does it in the Lithuanian world. The collection of the individual dharmas goes on to define harmony at the cosmic level.

An important symbol of the Romuva is the Austras Koks, "tree of dawn," or "tree of life," Skt. Auśas kakṣa औषस् कक्ष, which is another name for Kalpataru, the tree of life.

The Romuva cosmology sees Perkūnas (Skt. Parjanya, पर्जन्य) and Žemė as father and mother of all beings, which is identical to the characterization of Parjanya and Pṛthvī/Kṣamā (Earth goddess) in the Atharvaveda (12.1.12 and 12.1.29).

> Žemė, Žemyna, (Skt. Kṣamā, क्षमा, Earth). The Earth Goddess. Skt. क्ष also means field and from this we get क्षेत्र; from it also came Avestan zå which led to Persian zamin زمین. Zemes Māte is the Earth Mother (Skt. Kṣamā Mātā क्षमा माता). We find Dyukṣam in RV 10.185.1 as a pairing of Heaven and Earth and also as that of Parjanya and Kṣamā.
>
> Ašvieniai, Skt. Aśvinau अश्विनौ. They are the horsemen to the gods who symbolize the morning and the evening lights.
>
> Aušra, Skt. Uśā उषा. Dawn. She represents spiritual intuition.
>
> Laima, Sk. Lakṣmī, लक्ष्मी? She is responsible for luck and happiness.
>
> Saulė, Skt. Sūryā सूर्या. She is the Sun goddess who marries the Moon. The Ṛgvedic hymn 10.85 describes the iconic wedding between Sūryā (daughter of Sūrya) and Soma = Māsā (Moon). Sūryā-Māsā is mentioned five times in the Ṛgveda, and an additional three times as Sūryā-Candramāsā.
>
> Medeinė, Skt. Medini मेदिनि, is another aspect of Earth as protector of forest, trees, and animals (AV 12.1.33)
>
> Veju Māte (Skt. Vāyu Mātā वायु माता) is the Wind Mother.
>
> Veles (Skt. Vala वल). In Baltic mythology, Veles is a malevolent spirit of the dead. In

the Vedas, Vala is a demon who takes the form of a stone cave which is split by Indra to liberate the cows and Uṣas; mentioned 23 times in the Ṛgveda and also in the Atharvaveda,

Indraja, इन्द्रज, born of Indra, is the name for Jupiter.

CONCLUSIONS

Given the richness of the trans-Himalayan Vedic tradition and its new relevance in the Age of Machines where humans, who are alienated from the Spirit, wish to know this mystery more than ever before, it will become increasingly attractive to new seekers, which will lead to further faultlines in the Slavic lands and beyond.

The Bolshevik Revolution of 1917 was a rebellion similar to those that had occurred earlier against the Germans; likewise, the throwing off the yoke of Communism in 1991 expressed a yearning for a mythic past. The Slavs, or the Baltics haven't yet made peace with this past, and so one would expect that their angst will persist for much more time.

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12
When Xinjiang Was a Part of the Indic World*

The recent standoff between the forces of China and India in Ladakh has brought attention to the entire region. Although the recent political history of the area is well-known, what is of particular significance for China's view of seeing itself as successor to the historical Chinese empire is that Ladakh as well as Xinjiang, known in Sanskrit texts as Uttarakuru, were part of the Indic cultural world for centuries.

The region was included in the Kushan Empire of Kaniṣka of second century CE. The first millennium CE became the golden age of the Tarim Basin (northwest of Tibet below the Tian Shin Mountains) after the Kushans, and various Indic city-states thrived along the Silk Road, and these included Kashgar, Khotan, Turfan, Kucha, Niya, and Loulan.

Cities of Taklamakan and Gobi deserts in Xinjiang were conquered by Kashmir during the reign of the Kārkoṭa king Lalitāditya Muktāpīḍa in the eighth century as mentioned in the *Rājataraṅgiṇī* and accepted by the historian André Wink in his book *Al-Hind, the Making of the Indo-Islamic World*.

The name Xinjiang ("new frontier") is of recent vintage; it was chosen in 1884 by Qing China to replace old names such as Eastern Turkestan and Altisheher (= Six Cities). The people of this region are called Uyghurs and their preferred name for the region is "Uyghuristan". The Turks or the Chinese have no proper etymology for Uighur or Uyghur (维吾尔) which is written in Arabic script as 'ئۇيغۇر'. According to one theory, Uyghur is derived from Uttarakuru.

The lands beyond the Himalayas - Uttarakuru (in the east) and Uttaramadra (in the west) - do not figure in the earliest Vedic books. In the Mahābhārata, Uttarakuru is paired with Dakṣiṇakuru to the south of the Himalayas. The distance between these regions can be estimated from the military campaign of Arjuna described in the Sabhāparvan. After crossing the White Mountain (Śvetaparvata), Arjuna marches through Haimavata and reaches the Mānasarovara Lake in the country of the Hāṭakas. From there he enters the region called Harivarṣa, beyond which lies Uttarakuru.

In the Aitareya Brāhmaṇa (8. 14), it is stated that the Uttarakurus consecrate their kings by Vedic rites. Later, in the same text (8. 23), Vāsiṣṭha Sātyahavya anoints Jānaṃtapi Atyarāti according to the ritual of Aindra Mahābhiṣeka, who, in consequence goes out to conquer the world. Some scholars see the Kurus sweep further into Persia and later into Sogdia, Anatolia and beyond. Another section of the Kurus, called Prātipeyas, are known as Bāhlikas since one of the sons of Pratīpa was called Bāhlika, indicating association with Bactria.

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* Chapter in Shakti Sinha (Ed.), One Mountain Two Tigers: India, China and the High Himalayas. Pentagon Press, 2020.

EXPANSION OF THE VEDIC PEOPLE

A Puranic legend says that Vaivasvata Manu had nine sons, including Ikṣvāku, and a daughter, Iḷā or Ilā. The descendants of Ikṣvāku are members of the Sūryavaṃśī solar dynasty and Rāma of Rāmāyaṇa fame was born in this line.

Budha, the son of Candra, and Ilā had a son named Purūravas (also in Ṛgveda 10.95.18). Purūravas's great-grandson was Yayāti who had five sons: Yadu and Turvasu/Turvaṣa, sons by his wife Devayānī, and Druhyu, Anu and Pūru, sons by his wife Śarmiṣṭhā. The Pūrus ruled around Kurukṣetra, the Anus to their north, the Druhyus to the west, the Yadus to their south, and the Turvasus to the east of the Yadus.

At the end of the Ten-kings (dāśarājña) battle of the Ṛgveda, the Pūrus expand westwards and Anus push outwards into Afghanistan leading to a further northwards push to the Druhyus who went out into Central Asia. The migration of these tribes westward from India is to be found in Vāyu P. 99.11-12, Brahmāṇḍa P. 3.74.11-12, Matsya P. 48.9, Viṣṇu P. 4.17.5, Bhāgavata 9.23.15-16.

Ptolemy's Geography refers to Ottorokorai (Uttarakuru) tribe, Ottorokora as a city, and Ottorokoras as a river. Other scholars believe that the Tokhari (Tukharas) are the same as the Rishikas (Ṛṣika), who are mentioned in Sanskrit texts.

Kushan Empire (2nd century CE)

LANGUAGES IN UTTARAKURU

Many people in the Tarim Basin spoke Sanskritic languages such as Gāndhārī, which has Dardic features that it shares with Kashmiri, and the closely related Khotanese Saka. West to this region in Bactria and lands beyond, Aryan languages used include not only Avestan and Pahlavi but also the language of the Kushan Emperor Kaniṣka in his Rabatak Inscription.

History tells us of the presence of Jats to the west of the Tarim Basin who ranged all the way from Central Asia to Danube in Europe. Their language was most likely Indo-Aryan because if it were different then the large communities of Jats in India (as large as 30 percent in some states) would have been able to maintain their linguistic apartness. The historian Arnold J. Toynbee wrote thus: "It may not be fantastic to conjecture that the Teutonic-

speaking Goths and Gauts of Scandinavia may have been descended from a fragment of the same Indo-European-speaking tribe as the homonymous Getae and Thyssagetae and Massagetae of the Eurasian Steppe who are represented today by the Jats of the Panjab."

According to the standard view, Avestan is literally identical with Sanskrit. If that is true, Avestan should be Indo-Aryan. Or, Indo-Iranian should be taken to be the same as Sanskrit, with a division in time into various Prakrits that include Indian and Iranian languages. From this perspective, the Śaka languages of Central Asia are Prakrit languages. But even if we don't go this far, we know that Gāndhārī of the Tarim Basin is an Indo-Aryan Prakrit.

There is also evidence of Indic deities in the Śaka regions. These include Śiva-Maheśvara, Skanda, Gaṇeśa, Nārāyaṇa, Umā and others as, for example, in the Mogao Grottoes. The Zoroastrian Sogdians even went to the extent of fusing Maheśvara with their own divinity.

TARIM BASIN AND KHOTAN

Perhaps the region to most compare the Tarim Basin is Kashmir. Kaniṣka called the Fourth Buddhist Council in Kashmir, and subsequent to that there was much interaction between the two regions with many scholars traveling from there to Khotan and beyond.

Gāndhārī inscriptions have been found as far east as Luoyang and Anyang in Henan province in Eastern China which attests to the vastness of the influence of Sanskrit. Europeans in recent centuries called the whole region Serindia, indicating the meeting place of China and India.

Khotanese kings were Mahāyāna Buddhist but we know this sect incorporates Vedic and Tantric systems, with all the divinities such as Indra, Śiva, Viṣṇu and Sarasvatī, and just places the Buddha at the head of the system (as in Vidyākara's Treasury). There was also Krishna worship in Khotan and we find the Rāma story in Khotanese language, of which there is also a Tibetan version.

The Buddhists put a characteristic spin on the Rāma story, which has had immense power on the imagination of the people all over Asia. The Khotanese Rāmāyaṇa is not the standard Rāma story. In it Daśaratha, who is called Sahasrabāhu ("thousand-armed"), fights with Paraśurāma and gets killed, and his sons Rāma and Lakṣmaṇa are saved by a queen. When they grow older they slay Paraśurāma in revenge and become masters of all Jambudvīpa.

Meanwhile, the Rākṣasas are ruled by Rāvaṇa (Daśagrīva). A daughter is born to his chief queen and it is prophesied that she will be the cause of his ruin. So he orders the girl, Sītā, to be cast upon the great river in a box. A ṛṣi chances upon the box and raises the girl lovingly. This is of course somewhat similar to the account in Adbhuta Rāmāyaṇa.

Later in the story, Rāma, Lakṣmaṇa and Sītā are in the forest and as the brothers leave to hunt, Lakṣmaṇa draws the magic circle around Sītā for protection. Daśagrīva sees this lovely woman from the air, and not knowing she is his own daughter, approaches her and persuades her to step out of the circle to abduct her.

There is war and Daśagrīva is defeated. But in the end Rāma doesn't kill him. At the

end of the story, the Buddha Śākyamuni is identified with Rāma and Maitreya with Lakṣmaṇa. Daśagrīva comes to the Buddha and receives instruction in the Dharma as in the Laṅkāvatārasūtra.

The traditional date for the founding of Khotan, on the southern and the more ancient branch of the Silk Road, is the reign of Aśoka Maurya (3rd century BCE) and these accounts inform us that it was settled by Indians from northwest India. It was ruled by Buddhist kings until it was conquered by the Muslims in 1006. Some of the kings mentioned in the "Prophecy of the Li Country", composed in 746 CE, dealing with events of the recent past are Vijaya Kīrti, Vijaya Saṅgrāma, Vijaya Dharma, Vijaya Saṃbhava, and Vijaya Vāhana.

Many Khotanese cities had Sanskrit names. For example, Khotan in Sanskrit was Gaustana गौस्तन (or Gosthāna गोस्थान) and the modern city of Kashi (Kashgar) was called Śrīkrīrāti (in Sanskrit Śrī+krī+rāti, श्रीक्रीराति, 'Glorious Hospitality'). Kashgar itself appears to be the popular name from Sanskrit Kāśa+giri (काशगिरि, bright mountain). The Khotanese called their language hvatanai ह्वतनै which later became hvaṃnai ह्वंनै; this is equivalent to the name deśī that is used for language in India (vatan, from svatana = deśa).

The liturgical texts in the region were written in Buddhist Hybrid Sanskrit, whereas those in the region of Krorän (Chinese Loulan), an important oasis further east of Khotan, used Prakrit in administration. A third language called Tocharian was also used both to translate Buddhist texts and as an administrative language. Many Sanskrit texts of India remember the general region as Tuṣāra or Tukhāra, and it retains currency as a popular proper name.

That Khotanese Saka was principally an Indo-Aryan Prakrit is reinforced by the fact that the texts are in Indian scripts of Brāhmī and Kharoṣṭhī. Many of these documents were collected in archaeological explorations to Chinese Turkestan by Aurel Stein, who is also known for his translation of Kalhaṇa's Rājataraṅginī. Stein came across tens of thousands of manuscripts from 5th to 11th centuries in various sites including the Caves of the Thousand Buddhas in the Kansu (Gansu) province. One of the principal scholars who edited and translated many of these texts was H.W. Bailey and this literature remains a popular field of study for scholars.

Aurel Stein says in his celebrated Ancient Khotan: "There was little to prepare us for such overwhelming evidence ... on the large place which Indian language and culture must have occupied in the administration and daily life of this region during the early centuries of our era. That Sanskrit Buddhist literature was studied in Khotan down to the end of the eighth century A.D. has been proved beyond all doubt by the texts in Brāhmī script which I excavated."

THE MUMMIES OF THE TARIM BASIN

The discovery of the Tarim mummies that go back to 1800 BCE strengthen the view that the region was Sanskritic. The earliest mummies in the Basin are exclusively Caucasoid, and the American Sinologist Victor H. Mair has said: "Because the Tarim Basin Caucasoid corpses

are almost certainly the most easterly representatives of the Indo-European family and because they date from a time period that is early enough to have a bearing on the expansion of the Indo-European people from their homeland, it is thought they will play a crucial role in determining just where that might have been."

Some have suggested Europoid identification to explain the blonds and red-heads among the mummies, but there is no need to travel thousands of miles to Western Europe to explain this; Kashmir, just south of the Basin has plenty of red-heads and blonds.

One of the DNA studies notes that the population had "relatively close relationships with the modern populations of South Central Asia and Indus Valley, as well as with the ancient population of Chawuhu." This is perfectly reasonable if the original inhabitants of the region were from Indus Valley [code for India] and they left a genetic trace in the region.

THE END OF A CIVILIZATION

Protected by the Taklamakan Desert, the Tarim Basin world survived attacks from steppe nomads for a long time. There was a break in the tradition of Buddhist learning during the social and political turmoil under Tibetan rule from after 790 to the mid-9th century. Things began to change with the arrival of Turkic immigrants, who included Buddhist Uyghurs and Muslim Karluks, from the collapsing Uyghur Khaganate of modern-day Mongolia in 840.

The Islamic attacks and conquest of the Buddhist cities east of Kashgar was started by the Turkic Karakhanid Satuq Bughra Khan who converted to Islam and killed his step-father and uncle Oghulchak Khan who was the last Tengric ruler. Islamic Kashgar launched many jihads which eventually ended in the conquest in 1006 of Khotan by the Karakhanid khan Yusuf Qadir.

The end of civilization makes one question assumptions about life. Going beyond ephemeral loves and heartbreaks, does one see it as *parikalpa* (false assumption) and *śūnyatā*, as scholars had argued? There was no time for philosophizing, and fearing the worst, monks during the reigns of Khotanese kings Viśa Śūra (r. 966–977) and Viśa Dharma (r. from 978) began to copy texts which were sealed in caves to be preserved for posterity. What followed was a period of destruction and vandalism equaling the worst elsewhere in the world.

At the end of it, the populace retained no memory of their collective past and until the discovery of the mummies and the literature they did not know that their ancestors spoke Indian Prakrits.

The end of the earlier civilization was commemorated by the Karakhanid scholar and lexicographer Mahmud al-Kashgari (11th century) in a short poem:

kãlñizlãyũ aqtimiz
kãndlãr õzã čiqtimiz
furxan ãwin yiqtimiz
burxan ũzã sičtimiz

"We came down on them like a flood,

We went out among their cities,
We tore down the idol-temples,
We shat on the Buddha's head!"

Kashgari confirms that the people of Khotan did not originally speak Turkic. This is what he says of Tibet and Khotan: "Tubut [Tibet] have a language of their own. Khotan also have both a script and a language of their own. Both of these do not know Turkic well." As mentioned before, these people now call themselves Uyghurs.

Buddhism survived in certain parts of Xinjiang for some more time. The Kingdom of Kocho and Turfan was attacked by the Chagatai ruler Khizr Khwaja in 1390s, but Buddhism maintained its presence there until the 1450s. The Kingdom of Kara Del were subjected to a holy war by Chagatai Khan Mansur as late as 1516, which is around the time Babur was making plans to conquer North India.

Perhaps this forgetting of their own history has been responsible for the unsettled conditions that have persisted in Xinjiang and neighboring regions. For example, the conflict called the Dungan Revolts of the late 19th century resulted in a population loss of nearly 20 million people in Shaanxi and Gansu provinces due to massacres, war-related deaths and migration.

The past history of the Uyghurs came to light after documents was discovered in 1900 in the Mogao Caves, which had been walled-up in the 11th century.

KASHMIR AND KHOTAN

In India of two thousand years ago, there were powerful intellectual currents not unlike what is happening in the world now. The Buddha's doctrine of *anatta* (*anātmā*), "no-self," or the teaching that the sense of a permanent, autonomous self is an illusion, led to questions such as: What is it that gives an individual a sense of continuity? Is there free will? In a similar vein, modern science, which is based on reductionism and materialism, cannot explain free will, which is driving increasing scientific interest in the phenomenon of consciousness.

The theory of *anatta* arose within the context of the Vedic tradition, which does not suffer from the problem of free will for it postulates ātman, or self or consciousness, as the ground-stuff of reality, further speaking of two kinds of knowledge, higher relating to the experiencing self, and lower relating to objects of observation. The Vedic tradition enjoins the use of different lenses (darśanas) that provide complementary cognitions to further understanding of reality. Of course, it leads to other kinds of questions and paradoxes, such as how does the individual forget his or her true nature. But the Vedic tradition requires postulation of a category that goes beyond ordinary rationality, which is what the Buddha was trying to avoid.

A school called *Sarvāstivāda* arose to provide a logical basis to Buddha's idea of *anatta*. The name of the school is from Sanskrit *sarvam asti*, that is "everything exists/all is." It assumed that *dharmas*, universal entities that combine momentarily to form a person's life flux, were eternal. In spite of its limitations, this view became the most favored in the

famous council in Kashmir during the reign of the Emperor Kaniṣka and remained highly influential for centuries not only in India but also in Central Asia.

The doctrine of Sarvāstivāda had to compete with Nāgārjuna's Madhyamaka, the Middle Way, according to which reality at the deepest level is śūnyatā, or emptiness. Since the self is predicated on emptiness, phenomena take existence only as they relate to other phenomena and it is incorrect to say if something exists or does not exist. The middle way stands between affirmation and negation.

Mahāyāna also came up with the idea of Buddha Nature, which is taken to be the fundamental nature of all beings. To its critics, Mahāyāna brought in "ātman" through the back door, but it did so only in a half-hearted way for it does not admit the possibility of self by itself.

We know that Mahāyāna eventually triumphed in China. Perhaps, the individual most behind this triumph was Kumārajīva, who is known primarily as a translator of fundamental religious texts from Sanskrit to Chinese. Much of the material on his life comes from the Lives of Eminent Monks, *Gaoseng Zhuan*, which was compiled in 530.

KUMARAJIVA

Kumārajīva's father, Kumārāyana, who was from a prominent Kashmiri family, renounced his home to become a monk to seek fortune in far lands. His path took him to Kucha, on the northern rim of the Tarim Basin of Xinjiang, where the king, knowing of his name, persuaded him to stop his journey and appointed him the state preceptor.

While in Kucha, Kumārāyana fell in love with the King's sister, princess Jīva, who was a scholar in her own right. They married and in due course (344) they had a son, whom they named Kumārajīva. The boy showed signs of exceptional promise, and he had much interest in subtle argumentation.

But Jīva's marriage didn't go as well as she had hoped and she became a nun and joined a monastery together with her seven-year-old son. Two years later they traveled to Kashmir to study under the famed Buddhist teacher, Bandhudatta. In addition to the texts of the Sarvāstivāda School, the boy also learnt the Vedas, the darśanas, Ayurveda, astronomy and other sciences.

After three years of study, they began their return journey, but as they passed through Kashgar (Kāśagiri, the Mountain of Light, also known as Kashi), the local king, who had heard of the precocious boy, asked the mother and son to stay on for some time. While in Kashgar, Kumārajīva's Sarvāstivāda position was challenged by a teacher named Sūryasoma, a prince of Yarkand, who was instructing him in Mahāyāna texts. Kumārajīva, having studied the Veda, and aware of the basic problem of the self in his earlier position, accepted the Mahāyāna position and was to become its most articulate votary. In the Mahāyāna view, all dharmas are themselves unreal; ontologically, dharmas are like empty space and assume distinct existence only in their ephemeral combinations.

Kumārajīva was so impressed by his new understanding that he invited Bandhudatta, his first teacher in India, to come to Kashgar and soon converted him to his new position. He

became adept in debates on Madhyamaka, and scholars and monks came from all over to learn from him.

Knowing that her son had established himself as a teacher and convinced that he was going to do great things, Jīva decided it was best for her to return to Kashmir to continue her own studies; mother and son never saw each other again.

GENERAL'S PRISONER

Buddhism had already made much headway in China, but given its many competing sects, its exact trajectory wasn't clear. The sutra texts were not well understood because of literal translations, and so in 379, the Qin Emperor Fu Jiān brought the scholar Dao'an to his capital at Chang'an to establish a center for the translation of the texts. Dao'an, aware of Kumārajīva's reputation as a scholar, urged Fu Jiān to invite him to join the effort.

The emperor, in 383, sent his general Lu Guang with an army of 100,000 infantry soldiers and 5,000 cavalry to march on the western states to extend his domain and also to get Kumārajīva. Kucha resisted, was put under siege and eventually submitted in 384. Meanwhile, in 385, Dao'an died and Fu Jiān was decisively defeated and killed by the numerically inferior army of Eastern Jin.

When Lu Guang heard of the defeat of his emperor, he halted his return, declared himself independent, and set up a state now known as Later Liang at Guzang. He held Kumārajīva under virtual house arrest for sixteen years until he died in 400. Eventually Yao Xing, second ruler of the new dynasty at Chang'an, sent in his army and conquered Guzang. Kumarajiva was rescued unharmed, and in 402 he was welcomed into Chang'an.

TRANSLATION CENTER IN CHANG'AN

When Kumārajīva arrived in Chang'an, Emperor Yao Xing bestowed upon him the title *Teacher of the Nation*. Now began the most productive phase of his life, which resulted in works that have profoundly influenced Chinese Buddhist tradition to the present day. In a short period that was to last barely a decade, he translated almost fifty works including the Prajñāpāramitā प्रज्ञापारमिता literature such as the Vajracchedikā Prajñāpāramitā Sūtra (Diamond Sutra) वज्रच्छेदिका प्रज्ञापारमितासूत्र, the Vimalakīrti Sūtra विमलकीर्ति सूत्र , the Lotus Sūtra, and the Śūraṅgama Sūtra शूरङ्गम सूत्र, that add up to nearly three hundred volumes. Chang'an had at this time many international scholars who enlivened its intellectual atmosphere, and these included people such as Buddhabhadra, Buddhayaśas, Dharmayaśas, and Dharmagupta.

Kumārajīva's main contribution to the translation enterprise was to abandon the old style of literal translation that had proven ineffective in previous centuries. He chose to be guided by the intuition of an independent ontological position for consciousness, which made him give greater importance to the communication of deeper meaning.

He and his colleagues produced texts which were readable and inspiring, and after a millennium and a half his translations are still read and admired. Kumārajīva's most famous

and enduring work is the rendition of the Lotus Sūtra, known in Sanskrit as सद्धर्मपुण्डरीक सूत्र, the Saddharma Puṇḍarīka Sūtra, "Sūtra on the White Lotus of the Sublime Dharma." In part due to the excellent quality of the translation, devout Buddhists in East Asia believe that the Lotus Sūtra contains the final teaching of the Buddha, and that it is complete and sufficient for salvation. The world's oldest datable printed book is his Diamond Sutra of 868 CE that was found in the Dunhuang Caves.

His translation of the Pañcaviṃśatisāhasrikā-prajñāpāramitā Sūtra shows that he advanced an interpretation that appears to be consistent with Vedanta. Thus speaking of śūnyatā, *emptiness*, he says: "What is seen does not differ from what is empty, what is empty does not differ from what is seen. Form is emptiness, emptiness is form. It is the same for feeling, perception, intention and consciousness."

Scholars normally take śūnyatā to be the central theme of Prajñāpāramitā Sūtras. Kumārajīva gave it a twist so that one could take fullness of form to be equivalent to it, quite like how the Upaniṣads speak of reality in its two conceptions. This explains why lived Buddhism in the East is different from what is taught in the academy.

Many scholars believe that Kumārajīva's extraordinary skills as a translator and his passion for the Middle Way helped define the direction that China's culture took in the succeeding centuries. It is possible that if he had remained a believer in the Sarvāstivāda doctrine, the nature of Chinese religion would have turned out to be different even if he had translated the same texts.

INDIAN INFLUENCE BEYOND KUMARAJIVA

Indian influence on the intellectual and cultural life of China continued for centuries after Kumārajīva. It was so pervasive that Hu Shih (胡適), one of the most influential figures of modern China, a founder of the May Fourth Movement and president of Peking University, proclaimed in an essay titled *Indianization of China* that "India conquered and dominated China culturally for twenty centuries without ever having to send a single soldier across her border."

Hu Shih was an astute observer and he realized that India under the British was a ruined nation, partly because of the dominating role of English in India's public life. He began the New Literature Movement to replace Classical Chinese with written Mandarin, or "baihua", as the standard written language. In this reform he sought inspiration from traditional Chinese culture rather than borrowing from the West and his renaissance program was perfectly consistent with what Kumārajīva had done in his emphasis on readability of the texts.

13

Space and Order in Prambanan*

INTRODUCTION

This essay presents new ideas regarding the plan of the 9th century Prambanan complex and the number of its subsidiary shrines (candi perwara). Sometimes viewed as derived from the Somapura Mahāvihāra of Bengal which was built by Dharmapāla (r. 770-810) of the Pāla Dynasty (Rowland 1953), Prambanan is a *sarvatobhadra* temple with a terraced plan and a unique *maṇḍala* layout.

The historiography of Candi Prambanan is well summarized by Jordaan (1996, 2003). The largest temple compound dedicated to Śiva in Indonesia, the main complex has a size of 220×220 m which encloses the inner complex of size 110×110 m. The outer yard has 224 Candi Perwara temples (of size 6×6×14 m) in four descending terraces and within the inner yard is the Śiva temple which is flanked by temples to Viṣṇu at the north and to Brahmā at the south. Facing the Śiva temple is a subsidiary temple dedicated to Nandi, as is common for Śiva temples. Similar subsidiary temples face the Viṣṇu and Brahmā temples also, and although it is not certain what deities were originally installed there, they appear to have been Śiva and a Mahāyogi. The Śiva temple is 34×34×47 m in size, whereas its companion temples are 20×20×33 m.

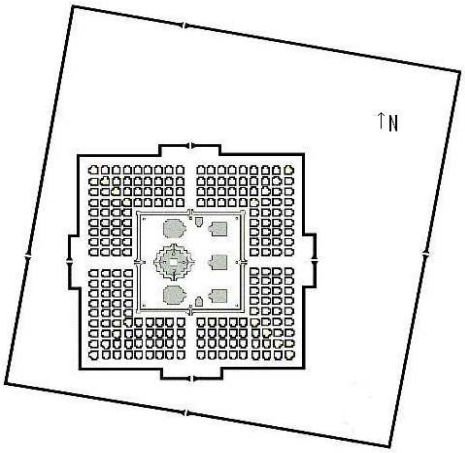

Figure 1. The Prambanan complex

Within the Śiva temple stands the image of Agastya to the south, Gaṇeśa to the west, Durgā Mahiṣāsuramardinī to the north, and images of Mahākāla and Nandīśvara to the east as doorkeepers. Durgā here is also called Loro Jonggrang, *Slender Virgin.* The temple is

* Chapter in *From Beyond the Eastern Horizon*, ed Manju Shree, 2011

named after the Goddess by the local population, namely Candi Loro Jonggrang.

The Purāṇas explain Durgā ("Unassailable") as emerging from the collective powers of the gods to fight Mahiṣāsura, the *asura* who has repeatedly defeated them. When seen as the consort of Śiva, she is the fierce aspect of Pārvatī. Since Durgā represents victory, her image commemorates a victory of the builder of the temple. The jar-born Agastya, who is also the star Canopus, is the teacher who planted the Vedic wisdom in a southern land.

The Śiva temple is on top of a terraced and richly decorated plinth, with stairs leading to the main entrance and those of side chapels. The terrace below is surrounded by another richly sculptured balustrade, with reliefs illustrating stories from the Rāmāyaṇa that continue on the terraces of the Brahmā and Viṣṇu temples. The details include Rāma slaying Bāli, the abduction of Sītā, the tender affection of Rāma and Sītā, Hanumān speaking to Sītā in the Aśoka garden, Rāma's crossing to Laṅkā. The prominence to the Rāmāyaṇa indicates that Prambanan may also be taken to be dedicated to Rāma as the ideal king, and Śiva, Agastya, and Durgā, connected to Rāma in the Rāmāyaṇa and the Purāṇas, are glorified for having brought him victory.

In the *Devi Bhāgavata Purāṇa*, when Rāma is despondent of reaching Laṅkā and defeating Rāvaṇa, the sage Nārada advises him to call on Durgā for help and instructs him on how to worship her, and this story is also found in the *Bṛhaddharma Purāṇa* and the Rāmāyaṇa by Kṛttivāsa (fifteenth century). According to Vālmīki, during the battle with Rāvaṇa when Rāma was exhausted, Agastya inspires him by reciting the *Āditya-hṛdayam* hymn. After Laṅkā has been defeated, Rāma worships Śiva in the form of a sand *śivaliṅga* at Rāmeśvaram to seek his forgiveness for having killed Rāvaṇa.

There are also Kṛṣṇa reliefs on the balustrade that surrounds the Viṣṇu shrine. The exterior to the first sub-basement of the Śiva temple has reliefs that show the *karaṇas* (dance poses) from Bharata's *Nāṭyaśāstra*.

Jordaan (1996) sees the temple as a representation of Mount Mandara, or Meru, suggesting that the surrounding terrace was flooded to represent the milky ocean during ceremonies. As support he cites passages, put in the mouth of Hanumān, that seem to describe this temple in the *Kakawin Rāmāyaṇa.*

This essay addresses questions related to the dimensions of the complex and the nature of its *maṇḍala* plan. It is shown that the sizes of the main temples are related to integer multiples of the standard measure of *dhanus* in India. We propose that the four terraces of the candi perwara shrines are the four concentric circles of deities around the central region in the Śri Yantra (also called Śri Cakra) and their number equals the emanations associated with further Tantric ideas that were popular around the time the temple was built.

The basic measure and Prambanan dimensions

Both proportion and size, seen most clearly in the prescriptions related to the images, are important the design of the Hindu temple (Kramrisch 1946). Recent studies haves shown that the unit of *dhanus* has been used consistently in India in town planning and architecture for over 4,000 years, going back to the Harappan period. By considering the largest measure

which leads to integer dimensions for the various parts of the Harappan age city of Dholavira, which was excavated in the 1990s (Bisht 1997, 1999), it was found that this measure is the same as the *Arthaśāstra* (300 BCE) measure of *dhanus* (bow) that equals 108 *aṅgulas* (fingers) (Kangle 1986; Danino 2008).

The measure of *dhanus* is seen to apply not only to the Mauryan and Gupta era structures (Balasubramaniam 2008), but even to more recent grid and modular measures in the town planning of Kathmandu Valley (Pant and Funo 2005). The measures used in ancient India are summarized in the table below.

Measure	aṅgulas	centimeters
aṅgula	1	1.763
vitasti (tāla)	12	21.156
pāda	14	24.682
aratni, P-hasta	24	42.312
C-hasta	28	49.364
F-hasta	54	95.202
daṇḍa	96	169.248
dhanus	108	190.404

The three different *hasta* measures have been called the Prājāpatya (*P-hasta*), commercial (*C-hasta*), and forest (*F-hasta*) by Balasubramaniam (2009), and used variously in different situations. Here we are concerned primarily with *dhanus*, although we will also encounter *pāda* and *aratni*.

Dhanus measure in town planning and architecture

With the measure of *dhanus* (D) of 1.9404 m, the dimensions of Mohenjo-Daro's acropolis turn out to be 210 × 105 D; Kalibangan's acropolis turn out to be 126 × 63 D. The dimensions of the lower town of Dholavira are 405 × 324 D; the width of the middle town is 180 D; and the inner dimensions of the castle are 60 × 48 D (Danino, 2008). The sum of the width and length of the lower town comes to 729 which is astronomically significant since it is 27 × 27, and the width 324 equals the nakṣatra year 27 × 12 (Kak 2009).

When considering temples and sacred buildings of historical times, we note that *Vāstu Śāstra* claims that the structure of the building mirrors the emergence of cosmic order out of primordial chaos through the act of measurement. The universe is symbolically mapped into a square that emphasizes the four cardinal directions. It is represented by the square *vāstupuruṣamaṇḍala*, which in its various forms is the basic plan for the house and the city. There exist further elaborations of this plan, some of which are rectangular.

The Somapura Mahāvihāra of Pāhārpur has dimensions of 280×281 m, which when converted to *dhanus* become nearly 147×147 D, or 49×49 with the units of three times *dhanus*, which would be a natural plan for a *vāstupuruṣamaṇḍala.* The base of the temple was generally in a square grid of 8 or 9 units (64 or 81 squares) in the *Bṛhat Saṃhitā* (Bhat 1995), but according to other texts it could range from one to 1024 square divisions (Kramrisch 1946:58). The *Vaikhānasāgama* gives special importance to the 7×7 plan.

The Brihadīśvara temple (which was completed in 1010), has a sanctum tower of 30.2×30.2×66 and it is within an enclosure of 240×120 m. In *dhanus* units, this amounts to 16×16 D plan in an enclosure of 126×63 D, where the error is less than one percent in the sanctum and almost zero for the enclosure. This indicates that the sanctum used a *vāstupuruṣamaṇḍala* of 64 squares where each square had a side of one-fourth *dhanus*.

Considering the *dhanus* unit outside of India, let us look at the Angkor Wat complex, where we use the dimensions given by Mannikka (1996).

Outer perimeter: 1024 × 802 m = 540 × 420 *dhanus* (error less than 0.4 percent); sum of the sides is 960 *dhanus*

Outer gallery: 187× 215 m = 97 × 113 *dhanus* (error less than 1 percent); sum of the sides is 210 which is one half the width of the outer parameter

Middle gallery: 100 × 115 m = 53 × 60 *dhanus*; sum of the sides is 113, which is the length of the outer gallery; it is also one-third the atmosphere + sky number of the Vedic altars (Kak 1993, 2000a, 2000b)

Inner gallery: 60 × 60 m = 32 × 32 *dhanus*; the inner gallery is a 64 × 64 *vāstupuruṣamaṇḍala* in half-*dhanus* units.

The number 113 is attested as an important number of Vedic ritual, and the representation of the inner gallery as a 64 × 64 *vāstupuruṣamaṇḍala* in half-*dhanus* units validates the use of the measure.

The Prambanan dimensions in dhanus

We now consider the Prambanan dimensions. In terms of *dhanus* units, the outer two perimeter sides are 116×116 D, and 58×58 D, respectively, with less than one per cent error. The Śiva temple becomes 18×18 D, with less than half-percent error. The dimensions of the Śiva temple mean a *vāstupuruṣamaṇḍala* of 9×9 = 81 squares where each side of the square is 2 *dhanus* long. This choice had a bearing on the ultimate dimensions of the temple. As we have seen in the later Angkor Wat dimensions as well, the squares of the *vāstupuruṣamaṇḍala* are either multiples of the *dhanus* unit or its simple divisors.

The side of the Viṣṇu and Brahmā temples becomes 81 *pāda*, which admits a

vāstupuruṣamaṇḍala of 9×9 *pāda*. Likewise, the perwara temples have sides nearly 25 *pāda* long, implying a *vāstupuruṣamaṇḍala* of 5×5.

The sum of the heights of the Viṣṇu or Brahmā temples (33 m) and the perwara temple (14 m) equals that of the Śiva temple (47 m). These heights are almost exactly equal to 78, 33, and 111 *aratni*, but we are not sure if these numbers had a special symbolism.

The Tantric Context

The evolution of the temples of the larger Hindu world was shaped by Tantric ideas that were shared by Hindus and Buddhists. The Tantras are a map of the inner cosmos for the discerning and ritual for the layperson, in which theological differences related to names do not matter (Goudrian and Gupta 1981). This explains how the eleventh-century Buddhist abbot Vidyākara in his anthology of Sanskrit poetry has 29 verses on the Buddha (together with the Bodhisattvas Lokeśvara and Mañjughoṣa), when he has many more on Hindu divinities, that is 74 verses on Śiva and his household (Pārvatī, Kumāra, Gaṇeśa, Nandī), 44 on Viṣṇu (including Lakṣmī, Rāma, Krṣṇa, Rādhā), and an additional 4 on Sūrya (Ingalls 1965). The same attitude was behind the building of both Hindu and Buddhist temples by kings, as in the example of Lalitāditya of Kashmir (Huntington 1985:360).

The idea of Tantra, inherent in the Upaniṣadic homology of the *Ātman* and *Brahman,* is the equivalence of the body and the universe (*piṇḍa* and *brahmāṇḍa*), which suggests recursion or repetition of patterns across space, scale and time. The *Atharvaveda* speaks of the city of gods, Ayodhyā, which is the body itself, and the *Chāndogya Upaniṣad* echoes this in describing the body to be the city of Brahman. A *yantra*, a representation of the inner cosmos, is described in the *Śvetāśvatara Upaniṣad*. Early Vedic ritual had some balance between the outer and inner elements but as the Hindu temple evolved, the representation of the inner cosmos became the predominant element, and the temple plan came to be based on *maṇḍalas* (Kak 2002, 2006).

It is significant that *yantric* buildings in the form of *maṇḍalas* have been discovered in North Afghanistan that belong to a period that corresponds to the late stage of the Harappan tradition around 2000 BCE (Kak 2000a, 2005b). Apart from orientation in the cardinal directions for temples or other monumental buildings, additional astronomical alignments were used. For example, in cave 6 of the Udayagiri complex on the summer solstice of the year 402 CE, the shadow of the Iron Pillar of Delhi (which was originally located at the entrance of the passageway) fell in the direction of the reclining Viṣṇu panel (Balasubramaniam 2008).

Tantric ideas were at the basis of much temple building activity in India in late first millennium by both Hindus and Buddhists. As mentioned before, the very basis of the temple plan is the *vāstupuruṣamaṇḍala* in which deities are mapped to different squares of the temple. But now in a further evolution of this idea a three-dimensional *maṇḍala* was used in the Somapura Mahāvihāra in Pāhārpur, and the Śri Yantra was installed in many Śakti temples such as the Kāmākṣī Amman Temple in Kanchipuram.

Vedic Cosmology and Temple Construction

Here I wish to show that Vedic texts are helpful in knowing the grammar that lies behind the constructions of the *śilpin* who consulted not only the *śilpaśāstras* but also texts like the *Śatapatha Brāhmaṇa* (ŚB) on how to synthesize the basic elements of the temple into new forms. The foundation of Vedic cosmology is the notions of *bandhu*, homologies or binding between the outer and the inner, each of which is viewed as having a tripartite structure. For example, in the Āyurveda medical system, the 360 days of the year are taken to be mapped to the 360 bones of the developing fetus, which later fuse into the 206 bones of the person.

The sacred ground for Vedic ritual is the precursor to the temple. The Vedic observances were connected with the circuits of the sun and the moon (Kak 1993, 2000a). The altar ritual was associated with the east-west axis and it maintained different day counts with respect to the solstices and the equinoxes. Specific days were marked with ritual observances that were done at different times of the day.

It was estimated correctly that the sun and the moon are approximately 108 times their respective diameters from the earth (perhaps from the discovery that the angular size of a pole removed 108 times its height is the same as that of the sun and the moon), and this number was used in sacred architecture. The distance to the sanctum sanctorum of the temple from the gate and the perimeter of the temple were taken to be 54 and 180 units, which are one-half each of 108 and 360 (Kak 2005a). This represents a ratio of 10 to 3 between the perimeter and the axis.

In the ritual at home, the householder employed three altars that are circular (earth), half-moon (atmosphere), and square (sky), which are like the head, the heart, and the body of the Cosmic Man (*Puruṣa*). In the Agnicayana, the great ritual of the Vedic times that forms a major portion of the narrative of the *Yajurveda*, the atmosphere and the sky altars are built afresh in a great ceremony to the east. This ritual is described at great length in the Brāhmaṇas. This ritual is based upon the Vedic division of the universe into three parts of earth, atmosphere, and sky that are assigned numbers 21, 78, and 261, respectively.

The numerical mapping is maintained by placement of 21 pebbles around the earth altar, sets of 13 pebbles around each of 6 intermediate ($13\times6=78$) altars, and 261 pebbles around the great new sky altar called the Uttara-vedi, which is built in the shape of a falcon; these numbers add up to 360, which is symbolic representation of the year. The proportions related to these three numbers, and others related to the motions of the planets, and angles related to the sightings of specific stars are reflected in the plans of the temples of the historical period (Kak 2009; Kaulācara 1966).

The Agnicayana altar is the prototype of the temple. 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. To represent two more layers of reality beyond the purely objective, a sixth layer of bricks that includes the hollow *svayamātṛṇṇā* brick with an image of the golden *Puruṣa* inside is made, some gold chips scattered and the fire placed, which constitutes the seventh layer (ŚB 10.1.3.7). The five layers are taken to be equivalent to the Soma, the Rājasūya, the Vājapeya, the Aśvamedha,

and the Agnisava rites. The two layers beyond denote completion, since seven is a measure of the whole. The meaning of this is that the ceremonies of the great altar subsume all ritual.

According to ŚB 7.4.1, within the hollow brick in the navel of the Uttara-vedi, a lotus-leaf is placed upon which is then placed a gold *rukma* (a disk, with 21 hangings), which symbolizes the sun. The golden *Puruṣa* (representing Prajāpati as well as the Yajamāna himself) is laid on the back with the head towards the east on top the *rukma*.

On the sides of the golden *Puruṣa* are two offering spoons, like two arms. Upon this image is placed the already mentioned *svayamātṛṇṇā* (self-perforated) brick. In total, there are three such bricks, in the centre of the first, the third, and the fifth layers. There are seven more bricks placed to the east of the *svayamātṛṇṇā* brick in the fifth layer. Next is a wooden mortar placed and on top of the mortar is placed the *ukhā*, the fire-pan which becomes the focus of the fire ceremony. The "sixth layer is the heavenly world, and the seventh layer is immortality" (ŚB 8.7.4.17-18).

The stūpa is easily seen as derived directly from the piled altar, with the relics of the Buddha replacing the golden *Puruṣa* within the hollow brick. The *garbhagṛha* of the Hindu temple likewise is an enlargement of the hollow space of the *svayamātṛṇṇā* (self-perforated) brick.

The worship of Śiva, Viṣṇu, and Śakti may be seen to have emerged from Agnicayana. The temple is not merely the buildings, the deity, but also the complex of the yajña, pūjā, or ceremonies performed there, so that in totality it represents both the being as well as the becoming. The becoming, or the transformation, requires the use of a special vocabulary related to inner processes. Briefly, Rudra is one of the names of Agni. According to Vājasaneyi S. 16.2, Agni has two forms, the auspicious Śiva and the fierce Rudra. During the building of the altar, Agni appears in its *raudra* manner, and to propitiate it the Śatarudriya homa is performed. This propitiation of Agni-Rudra is also done literally by a stream of water that drops out of an earthen pot hung over the *liṅga*. In one of the constructions of Nāciketa Agni, 21 golden bricks are placed one top of another to form the *liṅga* (*Taittirīya Brāhmaṇa* 3.1.1.6).

In the Vaiṣṇava tradition, the visualized golden *Puruṣa* is Viṣṇu-Nārāyaṇa who emerges from the navel of the lotus on the Uttara-vedi that represents the waters, and for this reason is also called Padmanābha. The golden disk upon the lotus is then the *sudarśana cakra* of Viṣṇu.

These ideas became the foundation for temple construction in later texts. According to *Tantrasamuccaya* I, ch 1 74-89 and *Śilparatna* 63, a treasure jar (*nidhikalaśa*) made of stone or copper is placed on the foundation stone (*ādhāraśilā*), on which a stone lotus is placed, upon which are successively placed stone tortoise, silver lotus, silver tortoise, gold lotus, and gold tortoise, which represents Viṣṇu upon whom the world rests. From there a funnel shaped tube, the Yoganāla, made of copper leads up to the plinth or to the lowermost molding (Kramrisch 1946:110).

The *garbhādhāna* ceremony, done in the Vedic times to steady the womb, is performed to the earth. The *garbha* vessel is made of copper, but it may be made of silver or

gold also. The vessel is lowered into the ground on an auspicious night. On its floor the serpent Ananta is drawn and it is placed on the hood of Ananta. On the lid of the casket, the maṇḍala of the earth is drawn (Kramrisch 1946:126).

It is not surprising that in the pits dug below the Śiva and Viṣṇu temples at Prambanan, gold plates and gold foil figures of a turtle, wheel, and serpent were found. Although some of the gold foil figures, such as the turtle, the spoked wheel, and the serpent are associated with the churning of the milky ocean, they cannot be taken as proof that this temple was a representation of the churning of the milky ocean.

The Perwara Temples

Several theories have been advanced for the choice of the count 224 for the perwara temples. According to Lokesh Chandra (1967) these temples represent the worlds of the cosmological system of the Śaiva Siddhānta, but the specific reference to this system was not indicated (Jordaan 1996:47).

I would like to propose that this count is related to Tantric ideas that were popular in the 9th century. The Śaivite philosopher Śaṅkara (788-820) speaks of the Goddess of the Śri Yantra in the *Saundaryalaharī* (SL). In SL11, the description of the Śri Yantra in terms of its 4 *Śrikaṇṭha* (upward pointing) and 5 *Śivayuvatī* (downward pointing) triangles, creating a total of 43 triangles is provided.

The Śri Yantra is the tripartite division of earth, atmosphere, and the sun, which is mirrored in the individual by the body, the breath, and the inner lamp of consciousness; it also represents the three parts of the body: neck to head, neck to navel, and navel to the bottom of the trunk. Its basic form is that of three triangles. Second, within each triangle are lower hierarchical levels of two other triangles, of alternating opposing polarity 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* that is the transcending union of the Goddess and Śiva, the Witness, or Consciousness.

The 42 outer triangles, each of which is associated with a deity, are arranged in four circles around the middle triangle, with counts of 8, 10, 10, and 14 in the four arrays.

According to SL 14:

Fifty-six for earth (mūlādhāra); for water fifty-two (maṇi-pūraka),
Sixty- two for fire (svādhiṣṭhāna); for air fifty- four (anāhata),
Seventy-two for ether (viśuddhi); for mind sixty-four (ājña cakra)
Are the rays; even beyond these are your twin feet.

These rays are the emanations from the body (of the Śri Yantra as well as that of the worshiper), and the verse claims that the transcendent Goddess remains beyond the domain of these rays. The six cakras are classified in *granthis* (knots) of two. The lowest two cakras correspond to 108 rays, the middle two to 116, and highest two to 136 rays. I suggest that the emanations of the lower two *granthis*, which add up to 224, are represented by the perwara

temples, as they are built out of earth, water, fire, and air. The additional rays of the highest *granthi* are mapped into worship and ceremony that corresponds to ether and mind.

Śaṅkara's influence on Indian thought and religion during his life was meteoric and it is likely to have resonated in Indonesia as well. Since Prambanan was completed only in mid-ninth century, it is reasonable to assume that the centrality of the Śrī Yantra in Śaṅkara's lived religion, as contrasted to philosophy and debate, influenced adepts and temple architects in Java. The four terraced round shrines of the candi perwara mirror the four circles of deities around the central triangle which is the place of the union of Śiva and Śakti and the similar count of 224 indicates that the Śrī Yantra was a model for the Prambanan temple.

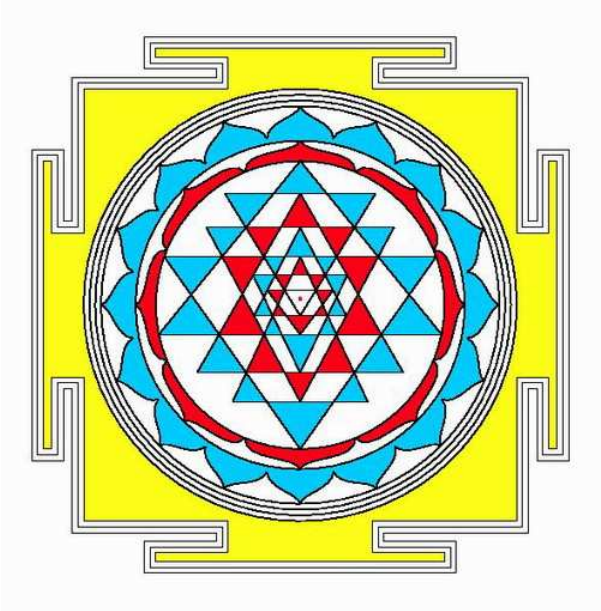

Figure 2. Śri Yantra, which represents the cosmos recursively

The *Devi Māhātmya*, which is a part of the *Mārkaṇḍeya Purāṇa* (c. 400), is the textual source for the worship of Śrī Yantra. It is significant that Ṛṣi Mārkaṇḍeya is believed to have brought Hinduism to Java and Bali. This no doubt represents the fact that the main form of Hinduism in Indonesia was Śaktism, in which one of the iconic images is that of Durgā as the vanquisher of Mahiśāsura, who is celebrated on the day after Navarātri ("festival of nine nights"). Durgā in this form is Caṇḍī, and it is appropriate that the temple in Indonesia came to have this name.

I would also like to propose that numbers related to the Ṛgveda explain the additional 10 temple within the complex. The number 43, central to the Śri Yantra, is the count of hymns in the second *maṇḍala* of the Ṛgveda. The first two *maṇḍalas*, which are the base of the 5-layered altar of mantras (Kak 2000a), have a total of 191+43= 234 hymns, which is equal to the count of the 224 temples in the outer yard together with the two *candi apit* and the 8 turret-like *candi kelir* temples inside the surrounding wall of the inner yard.

CONCLUSION

This essay has found an answer to the puzzle of the dimensions of the Prambanan complex in its use of integer multiples of the *dhanus* measure. We have suggested that the 224 Candi Perwara are the emanations associated with the Goddess in the Śrī Yantra system. The four terraced sets of candi perwara shrines are like the four concentric sets of triangles in the Śrī Yantra.

The proposed ideas in this essay make the Goddess central to the complex, which is consistent with the traditional view of the Javanese in which it is famous as Candi Loro Jonggrang and not Candi Śiva. It may be assumed that the King-commissioner constructed the temple with multiple dedications to Rāma as the ideal ruler, Śiva as the Great God, and Durgā as the goddess who guides one to inner and outer victory.

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14
Svetovid and Śiva*

INTRODUCTION

The parallels in art and mythology in Indo-European societies for widely separated regions that do not belong to the same sub-family are normally seen through the lens of linguistics and the supposed ancient shared past for the entire family (Kak, 1994). In the case of the Slavic world and India, the Balto-Slavic and Indo-Iranian language families are geographically next to each other and therefore for cultural factors not shared with Germanic, Italic or Celtic families, one should look for evidence of cultural transmission. We have considerable evidence of interaction via the Śaka (Scythian) (Greek: Σάκαι, Sákai) intermediaries who inhabited the Eurasian Steppe called Uttarakuru both by Indians and the Greeks. Indian texts remember Uttarakuru as a borderland of their cultural world (Kak, 2020) and Megasthenes and Strabo both mention the Uttarakuru as a land associated with the Indians.

The Śaka were multi-ethnic. Herodotus (1.201, 1.204.1) says that one tribe of the Śaka consisted of the Getae and Massagetae (cognate with Skt.: Jaṭa and Mahājaṭa) and it was settled somewhere in the great plains to the east of the Caspian Sea. Ptolemy's Geography 6.10.2 sees them much further south near Kashmir. Many scholars believe that the Getae mentioned amongst the Śaka are the Jaṭs who are found in very large concentration in India's northwestern states. There is no linguistic evidence suggesting they are an intrusive group in India.

The Śaka could have carried different cultural innovations in either direction. A most striking example of this are the figures on the Gundestrup Cauldron found in a bog in Denmark and dated to about 150 BCE that are clearly of an Indic origin: the Goddess being adored by two elephants (which is out of place in Europe), and the meditating figure in a pose that is nearly identical to the famed Paśupati seal of the Harappan culture (Taylor, 1992). It is generally believed that Thracian silversmiths most likely connected to the Śaka (and therefore plausibly in knowledge of the Indian art tradition) were responsible for its creation.

Multifaced images and multiple hands of divinities are a unique characteristic of Indian art (Mitter, 2001; Vatsyayan, 1995). This multiplicity serves the function of communicating abstract qualities and also marks them apart from humans. The qualities in the Vedic tradition often come as triads (the Vedas call themselves trayī-vidyā, triple knowledge) and pentads (to generalize to elements and senses). Multiple faces denote transcendent divinity as in Brahmā's four heads, or Krishna's innumerable heads in the universal form that is revealed in the Bhagavad Gītā. There are also images of the fusing of Śiva and Viṣṇu (Harihara) and Śiva and the Goddess (Ardhanāriśvara). In Atharvaveda 10.7,

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the cosmic pillar Skambha, without beginning or end, reaches into the heavens. The liṅga of Śiva is the iconic form of this Skambha. A Shaivite legend speaks of both Viṣṇu and Brahmā going in search of the ends of this column of fire. As Consciousness in which we perceive reality, Śiva is the Axis Mundi of the Universe. His symbolic abode is in Kailās, a mountain peak in the Himalayas.

Path to Kailas (Путь на Кайлас), painting by Nicholas Roerich, 1931
State Museum of Oriental Art, Moscow, Russia; https://www.wikiart.org/en/nicholas-roerich/path-to-kailas-1931-1

Śiva's symbol is Triśūla, trident, that represents trinities such as creation, maintenance, and destruction; past, present, and future; body, mind and atman. In an expansion beyond the three, Śiva is associated with five heads and they are 1) Sadyojāta, 2) Vāmadeva, 3) Aghora, 4) Tatpuruṣa and 5) Īśāna that refer to specific powers of Śiva (Pañcabrahmas) corresponding the five elements (earth, water, fire, air, and ākāśa) and other pentads (Table 1). It should be noted that pentads are also expressed in other Indian traditions: in the Śākta tradition they are: 1) Brahmā, 2) Viṣṇu, 3) Rudra, 4) Īśvara, and 5) Sadāśiva, and the Great Goddess Lalitā is called Pañcabrahma-svarūpiṇī; in the Vaishnava Āgamas (Pāñcarātra), they are named: 1) Vāsudeva, 2) Saṅkarṣaṇa, 3) Pradyumna, 4) Aniruddha and 5) Nārāyaṇa.

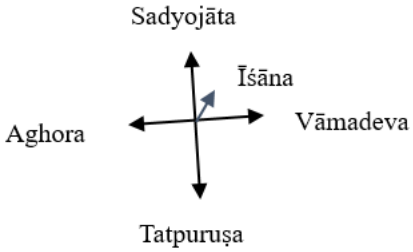

Figure 1. Five faces of Śiva (Īśāna, points upwards)

A common representation of these five heads is as separate faces in the cardinal directions with the fifth above them pointing upwards. The mukhaliṅga representation has four faces on the liṅga with the fifth assumed to be the shaft itself.

Turning to the Slavs, we note that there is no first-hand account of their religion or mythology. The earliest reference is by the 6th century Byzantine historian Procopius, according to whom the Slavs worshipped a deity of lightning and thunder that may be deduced to be Perun (Skt. Parjanya). Later accounts include the Slavic Primary Chronicle compiled at the beginning of the 12th century when the Western Slavs were forcibly converted to Christianity. The *Chronica Slavorum*, written in the late 12th century by Helmold, a Saxon priest and historian, mentions Zerneboh (Chernobog), goddess Živa, god Porenut, and other unnamed gods whose images had multiple heads. The three-headed Triglav (Dynda, 2014) and, the four-headed Svetovid (Jones and Pennick, 2013) were the most important of the Slavic deities. Like Śiva, both Triglav and Svetovid were seen as conceptualization of the axis mundi, and Helmold described Svetovid as *deus deorum* (god of gods).

In this article, we present evidence that the four-faced mukhaliṅga image was the prototype of the four-faced Svetovid image. Several parallels are adduced that include the sequence of the divinities on the images, and the way Svetovid was worshiped in its sanctuary. It is also noted that the Slavic color for Svetovid's eastern face is green, whereas for Śiva the corresponding color is golden, as is appropriate for the dawning golden Sun. It is proposed that this switch occurred since Sanskrit uses a single word *hari* for green and golden (yellow).

ŚIVA-MAHEŚAMŪRTI

There is simplification of the five-headed Śiva in three-headed Maheśamūrti, where most often either Sadyojāta or Tatpuruṣa is assumed to be behind the image (Collins, 1988). In this representation, the middle head most often is that of Tatpuruṣa as the form in which Śiva is concealed, flanked by Vāmadeva on the left, and Aghora (in a frightening form) on the right. Sadyojāta or Tatpuruṣa and the other two Vāmadeva, and Aghora are thus a form of the Puranic trinity of Brahmā, Viṣṇu, and Maheśa.

Table 1. The five faces of Śiva

	Sadyojāta	Aghora	Vāmadeva	Tatpuruṣa	Īśāna
Direction	West	South	North	East	Upwards
Color	white	black	red	gold	crystal
Element	*pṛthvi*, earth	*tejas*, fire	*āpaḥ*, waters	*vāyu*, air	*ākāśa*
pañcakṛtyas, five-fold acts	creation	dissolution	maintenance	delusion, concealment	grace, unveiling
Śiva's form	Brahmā	Rudra	Viṣṇu	Maheśvara	Sadāśiva

The four faces may be listed in a cyclic manner which deviates from the listing of the first four mahābhūtas in that fire and waters are switched (Table 2). This switching may be seen as caused by the working of the higher tattvas. In the Maheśamūrti, fire and water flank earth or air.

Table 2. The four faces in a cycle

Sadyojāta	Aghora	Vāmadeva	Tatpuruṣa

The spread of Śiva-Maheśamūrti of three heads from its Indian origin into Central Asia and China is well documented (e.g. Banerjee, 1992; Gallo, 2013), and scholars link this to the popularity of the Lakulīśa-Pāśupata sect. Perhaps the spread was also facilitated by the creativity of thought in the Shaivite tradition that led to the flowering of diverse arts and sciences (Kak, 2021). Indeed, Shaivism, as a theory of consciousness, continues to exercise powerful influence in contemporary thought.

The Maheśamūrti images is seen in the Elephanta and Ellora caves and in sculpture all across India (Banerjea, 1955). Beyond the borders of India, the image went to Khotan, and finally reached eastern China (Gallo, 2013). The first representations of it are found at Yungang (5th century CE), and Khotan (6th-8th century CE). Maheśvara was assimilated in Buddhism in Tarim Basin, China and in Sogdia presumably to deal with its popularity (Kumar, 1975), and this was happening back in India as well. Thus in the Kāraṇḍavyūha Sūtra, the sun and moon are said to be born from Avalokiteśvara's eyes, Śiva from the brow, Brahmā from the shoulders, Nārāyaṇa from the heart, and Sarasvatī from the teeth. Three- or four-faced Maheśvara images have been found in Chinese caves. It is believed that philosophers Asaṅga and Āryadeva tried to amalgamate Shaivism and Vaishnavism with Buddhism.

The Kuṣāṇa coin (2nd century CE) shown below provides an early example of the Maheśamūrti image in which the bull Nandi is included.

Figure 1. Kuṣāṇa coin with the Maheśamūrti image (2nd century). British Museum.

Figure 2 presents a standing Maheśamūrti image (9th century) with feet missing from Kashmir made of green stone from the British Museum.

Śiva-Maheśamūrti sculptures are found in India from the beginning of the Kuṣāṇa dynasty until the 10th century CE. They are analogous to the Trimūrti, the Puranic Triad comprised of Brahmā, Viṣṇu and Śiva. They represent a fully manifested Supreme Śiva endowed with the powers of creation, protection and destruction; the five-headed Śiva image is Sadāśiva, while the three-headed one is Maheśamūrti.

Figure 2. Maheśamūrti image from Kashmir in which the Aghora and the Vāmadeva faces are clearly seen. British Museum.

Figure 3. Śiva-Maheśamūrti in China (Gallo, 2013)

In the Maheśamūrti image, Sadyojāta, the generative aspect of Śiva, and Tatpuruṣa, the concealed form within beings, are always portrayed with a meditating expression, Vāmadeva has the role of sustenance and may be shown in a feminine appearance, while Aghora represents the concept of destruction and is usually depicted in the form of a ferocious Yakṣa (e.g. Figure 2). The disposition of the faces changes according to the sect, or varies depending on the ritual. It could be either Tatpuruṣa (center), Vāmadeva (left) and Aghora (right), or Sadyojāta (center), Aghora (left), and Vāmadeva (right). The arms of the figure may be holding objects such as a skull, a snake, a pomegranate, a rosary, a lotus and a mirror.

MUKHALIṄGA

The iconography and making of the mukhaliṅga is prescribed in the Āgamas and the Tantras. The shaft of the mukhaliṅga has three equal parts: the lowest part of the liṅga, which is a square platform, is called the Brahmā-bhaga, the middle section with a pedestal or pītha is called the Viṣṇu-bhaga, and the topmost part with a rounded tip is called the Rudra-bhaga. This is quite consistent with the inner and outer cosmoses of the Vedic conception with the three levels of the earth, atmosphere, and the heavens, which is mirrored in the Tantric conception of Brahmā, Viṣṇu, and Rudra *granthis* (knots) that are to be seen in the body from bottom up.

If the garbhagṛha has only one door, then the liṅga should have only one face on the front (eka-mukhaliṅga), in case of two doors, it should have two faces - front and back - facing the doors in the east and the west; In case of three doors, the liṅga should have three faces, except in the west. When the shrine has four doors, the liṅga may have four or five faces.

Figure 4. Four-faced mukhaliṅga from Nepal. Asian Art Museum, San Francisco.

The eka-mukhaliṅga has hair piled on the head like a bun, and longer hair flow over his shoulders, earrings and a necklace and the crescent moon on his head and the third eye on the forehead. The faces of Śiva are carved generally from the ear onwards, emerging from the liṅga.

Figure 5. Caturmukha Mahādeva Temple, Madhya Pradesh. Caturmukha Liṅga. 8th century. ANU.

SLAVIC DEITIES

According to historians, the supreme divinity amongst the Slavs was known as *Deivos* (cognate with Sanskrit *Dyaus*), and later it was represented as *Rod* (Sanskrit *Rudra* (?)). From this One, emerged *Belobog* (White God, Sanskrit *Bala-bhag*) and *Chernobog* (Black God, Sanskrit *Kṛṣṇa-bhag* (?)) from which arise the heavenly-masculine and the earthly-feminine deities.

The Slavs held on tenaciously to their beliefs until Christianity was violently imposed on them through the Northern Crusades. Christian chroniclers report that they regularly relapsed into their original religion (*relapsi sunt denuo ad paganismus*), and popular resistance was led by *volkhvs*, the priests of the old religion. This resistance gave rise to what has been called *whimsical syncretism* and *dvoeverie*, "double faith". Since the early 20th century, Slavic Old Religion has reorganized into the movement of Slavic Native Faith (Rodnovery).

The cosmology of Old Slavic religion is visualized as a three-tiered vertical structure, quite like the tripartite division of Vedic cosmology. The figures of Triglav and Svetovid are three-headed and four-headed representations of the same axis mundi, of the same supreme God. Triglav represents the vertical interconnection of the three worlds, reflected by the triads of the physical and the psychological universes.

Besides Triglav and Svetovid, other deities were represented with many heads, and Rugievit was shown with seven faces that converged at the top in a single crown. These images that were wooden or carved in stone, some covered in metal, were kept in temples that were regarded as the houses of the gods as is the case in the Hindu temple. They were wooden buildings with an inner cell with the god's image that parallels the garbhagṛha of the Hindu temple.

SVETOVID

Svetovid, the four-headed highest divinity, is known under various names: Światowid,

Svantovit, Swiatowid, Световид (Rybakov, 1987) and translated variously as "Holy Light", "Sacred Knowledge", or "Dawning One". Various sites dedicated to him have been found in Pomerania and there was a famous shrine to him on the island of Rügen at Cape Arkona, before it was destroyed in the 12th century by the Danish King Valdemar I and his adviser Absalon, Bishop of Roskilde. The image was wooden statue that showed Svetovid with four faces and a horn filled with wine. The statue was in a square, column-supported temple. Some consider Svetovid a local Rugian variant of the Slavic god Perun.

Figure 6. Bishop Absalon topples the god Svantevit at Arkona, as imagined by Laurits Tuxen (1853-1927). The Museum of National History, Denmark.

The temple to Svetovid was highly decorated with carvings and paintings. The size of temple was 20×20m and in inner part of building was the image of the deity, 8m height, also made of wood. In his right hand he held horn made of different kinds of metals. This horn was filled with wine or nectar. In his arms he held a bow and a sword made of silver. The body of statue was with carvings divided in three parts. The upper part symbolized the spiritual world, middle was material and the lower part symbolized the netherworld.

It is natural to ask if the name has anything to do with Sanskrit *Śvetavid*, श्वेतविद्, Knower of Light. To make sense of the name, remember that Śiva is also called Prakāśa (Light). Svetovid's nickname is Beli (or Byali) -Vid (*beli* = white, bright, shining; Skt. *bala* is white in *balakṣa* बलक्ष = white-beamed = moon).

Svetovid's north head is Svarog (Skt. Svarga, heavens); the red west face is Perun (Skt. Parjanya, a name of Indra); the black south face is Lada (cognate with Skt. Laḍaha, meaning beautiful); and the green east face is Mokosh (Skt. *Mokṣa*, a form of *Aredvi Sura Anahita,* or *Śurā Sarasvatī*). The description by Saxo Grammaticus that states that entry into the inside of the temple was severely restricted is similar to the restriction on entry to the Garbhagṛha in Hindu temples.

Figure 7. The Zbruch idol, a four-sided column made of limestone, appears to be the representation of Svetovid. Kraków Archaeological Museum.

Svetovid, is a four-sided column made of limestone from the 9th or 10th century. It was found in 1848 in the river Sbruch near the village Lychkivtsi in what was then Eastern Galicia, now Ukraine, and is now in the Archaeological Museum in Krakow.

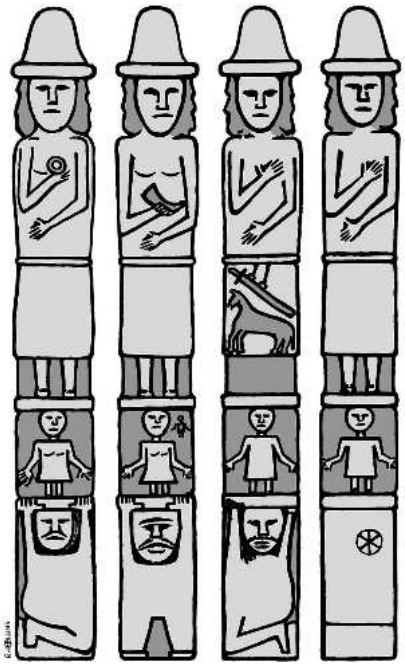

Figure 8. The lower part of the Zbruch image (Wikipedia)

Going from left to right, the female with the ring is Lada (Earth), the female with the horn of plenty is Mokosh, the male deity with the horse and sword is Perun, and the last on the right is the Sun. The two middle ones that concern lived life are enclosed by the Earth and the Sun. This representation can be reconciled with the four-faced representation of Śiva

in the following manner.

Table 3. The four faces in a cycle

Sadyojāta	Aghora	Vāmadeva	Tatpuruṣa
Lada	Mokosh	Perun	Sun

This correspondence is compelling. Lada, the Earth, represents birth which is naturally associated with Sadyojāta. Mokosh is plenty obtained out of freedom and this freedom is given by Aghora that is another name for Rudra. Perun sustains as does Vāmadeva, and Tatpuruṣa (the Self within) can be taken to represent the Inner Sun.

Rybakov (1987) claimed that the phallic shape at the bottom of the second figure represented the deity Rod and that seems fine for it is in correspondence with Rudra, the Vedic name for Śiva.

DISCUSSION

We have listed broad parallels between the Vedic and the Old Slavic religions related to divinities with multiple heads. We cannot see these as emerging at a time when the Slavic and the Aryan (Indo-Iranian) societies were in close proximity because multiple faces for divinities are absent in the Iranian sub-branch. They could not have come from the Slavic lands to India at a late stage - such as the time of the Kuṣāṇas -- because the history of such representation in India goes back to the Vedas itself (as in the image of the four-faced Brahmā) and the idea of the cosmic pillar from which everything emerges is in the Atharvaveda.

We have sourced the impetus for such representation to the great ferment in Kashmir related to Shaivism that began in early centuries CE, leading to extraordinary creativity in many fields (e.g. Kak, 2018; Kak, 2021), that motivated scholars to travel beyond the borders of India to spread these ideas. We have evidence that the idea of 3- and 4-faced representations of Śiva traveled to Central Asia and China, and it is plausible and almost certain that it went further beyond Sogdia to the Slavic world.

The conception of the goddess in the Śāradā Māhātmya speaks of Śāradā, Kashmir's version of Sarasvatī, as having three colors of Śveta (white), Rakta (red), and Śyāmā (black). One can propose that the image of Svetovid represents a fusion of the three colors of the Goddess with the fourth that is Light (Prakāśa, Śiva). The mystery of the green color associated with it comes from the fact that Sanskrit uses the same word *hari* for both green and golden, and this double use is from the fact that the plants in the field turn from green to golden when they ripen. That the names are all identical in Sanskrit and the color that got associated with Mokṣa in the popular imagination indicates that the synthesis original occurred in a Sanskritic land. The visualization with multiple faces with a count that agrees with the three colors for the Goddess and the golden color for Śiva, who represents freedom in the inner world and the sun in the outer, is consistent with the Indian conception.

If indeed the above sketch view is correct, one should add that the basic idea was given its full form within the existing old Slavic cultural tradition, which explains the details

of the iconography.

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PART 3

SANSKRIT AND THE WORLD

15
On the Classification of Indic Languages*

INTRODUCTION

Language, as part of human expression, may be viewed in analogy with genetic expression. Evolution of language is a result of complex temporal and spatial processes where, if one could aggregate the processes, one may speak in terms of parent traits and the resultant descendent traits. Insights from the theory of non-linear dynamics indicate that the multitude of interactions amongst speakers would lead to the formation of just a few languages. Strongly interacting systems of very many components, like assemblies of neurons or human speakers, have only a few stable interaction states, called attractors, associated with their behaviour,[1] and these, for speakers, are the various languages. In evolving systems, the nature of these stable states will also change. This is how isolated languages can be seen to change. But more significant than this process is the change due to interaction with other languages. With this background it is clear that a correct view of language evolution is within the framework of other interacting languages.

But for about one and a half centuries, language evolution has been studied using models inspired by early, mechanistic physics. Like a physical system that evolves due to radiation and other incident forces, languages were taken to change spontaneously. The spread of languages was explained by another mechanistic metaphor, namely, that of transfer of populations and invasions. This led to models of language families. The German philologist August Schleicher pioneered the tree approach in the 1860's which assumes that when populations are isolated their speech get increasingly differentiated until they become distinct languages; this assumption allows one to set up a family tree of languages. Representation of language families is predicated on an assumed chronology of evolution. Soon after Schleicher, another German linguist, Johannes Schmidt, theorized that linguistic changes spread in "waves" leading thereby to a convergence amongst languages that might have been dissimilar to begin with. In 1939 the Soviet linguist N.S. Trubetskoy suggested that the similarities among the Indo-European languages were due to the wave model of Schmidt. Scholarly opinion has generally dismissed "wave advance" theories and languages are generally characterized in terms of family trees.

ON LANGUAGE FAMILIES

But language family representation that does not consider the previous history of interactions cannot be reliable; even in the case of an isolated population it is too simplistic. Using the

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analogy of biological family trees, the daughter language must carry characteristics of the parent languages, where the parents aggregate the influence of all dissimilar languages and dialects.

If language grammar and vocabulary is likened to the genes of a biological organism, the daughter language picks up genes from both the parents. But since a language is defined by the interaction and behavior of diverse speakers across space and time, the actual inheritance in the daughter language is a chance phenomenon. Nevertheless, genetic classification of languages implicitly describes a single parent language. For example, Spanish, Catalan, French, Italian are seen to be the daughter languages of Latin without defining the other parents.

Theories of language evolution arose in the heyday of mechanistic physics, before the laws of genetics and quantum mechanics had come to be known. Since the discovery of these laws, no successful attempt has been made to establish a rational basis for inheritance of characteristics in languages.[2] Recent theories do claim to provide "genetic" classification, but the term "genetic" is used in an unscientific manner. It is used in a meaning equivalent to the old tree classification diagrams or in the operative sense of "random mutations". However, random mutations in biological evolution are supposed to represent the cumulative effect of complex interactions. Furthermore, significant mutations are seen only after many, many generations. The historical records related to languages exist over a time span that is relatively very brief and no convincing evidence exists that defines processes, over such a brief period, that are truly analogous to biological random mutations.

The current state of linguistics is due, in part, to the central place the study of Indo-European languages has had on the subject. Implicit in such a study has been the Eurocentric notion of the special place of the hypothesized Proto-Indo-European (PIE) language and thereby its homeland.

Circular arguments were used to postulate IE forms and then the words in the various IE languages were derived from it. The languages were related in terms of tree diagrams without considering the history of their interactions with other languages. Another recent tendency is to derive all languages from the same ancestor. Here the motivation is to use models that describe the genetic diversity of human populations. But I believe that we simply do not have the data at this point to determine whether language arose before the postulated early human migrations from the original single homeland of the humans. Neither do we know if there was a single such homeland.

The *comparative* method that has been used to reconstruct features of ancestral languages may be compared to a sieve. Using a sieve of a certain size to find diamonds in dirt, one may theorize that such diamonds have a certain minimum size. But such a theory does nothing more than declare the limitations of the sieve! This is not to say that languages are not related, but that the relatedness is much more complex than the techniques used in historical linguistics indicate. No wonder then that linguists have reached seemingly contradictory conclusions: (i) There is such typological commonality between the Indo-

Aryan, Munda, and the Dravidian languages that these languages should be considered a single super-group and India considered a "linguistic area,"[3] (ii) Sanskrit and Old-Indo-Aryan are strikingly similar to Old Iranian, a language taken not to have been influenced by Dravidian, so that the Avestan texts can almost be read as Vedic Sanskrit.[4]

With the backdrop of the above points, we take up the question of the classification of the Indic languages to illustrate the pitfalls of current theories. We argue that based on genetic classification, both the Indo-Aryan and Dravidian languages have had common parents and these languages share many typological categories.

INDO-EUROPEAN AND DRAVIDIAN

We first consider the wider question of the relationship between Indo-European and Dravidian. Three decades ago the Soviet linguists Vladislav M. Illich Svitych and Aron Dolgopolsky proposed that a number of Eurasian language families including Indo-European, Dravidian, and Afro-Asiatic belong to a superfamily which they called Nostratic,[5] derived from the Latin for "our (language)". Although the notion of the superfamily is sometimes taken to imply a common ancestor, it appears that a more reasonable assumption is that in the remote past the speakers of these languages interacted strongly resulting in many shared characteristics amongst the languages.

The idea of the superfamily has been increasingly accepted in recent years. The spread of these languages has been ascribed to various mechanisms. One mechanism is the "wave of advance" model of Ammerman and Cavalli-Sforza,[6] according to which the surplus produced by agriculture led to rapid increase of population density over earlier hunter-gatherer communities. The second popular model is that of elite-dominance; here the spread is generally ascribed to invasions.

It has been suggested that the ancestors of these three families may have lived in some proximity in Western Asia around 7000 B.C. Colin Renfrew sees the ancestors of the Indo-Europeans in Anatolia, those of the AfroAsiatics in Jericho, and those of the Dravidians in the Zagros.[7] If one postulates that early farming arose in these regions of Western Asia then the spread of farming by the "wave of advance" mechanism took their languages and genes into other areas. Although, the presence of Indo-European languages in Iran and India is explained by Renfrew as a later expansion by an elite that forced its language on the Elamite and the Dravidian speaking people, this is not convincing. This is a restatement of the theory articulated earlier by Childe8and others which has no archaeological evidence to support it.[9] There is no explanation for why suddenly hordes from Anatolia decided to push in the southeast direction and how they were able to impose their language on an area which was already heavily populated.[10]

There are other theories for the spread of the Indo-European languages, amongst which the most prominent is the "kurgan" theory of Marija Gimbutas[11] which is, however, concerned mainly with Europe. According to this theory kurgan warrior from north of the Black Sea invaded Europe in waves over the period 4300 to 2800 B.C. and imposed their languages on the indigenous Europeans. The expansion into Iran and India in the Gimbutas

scheme is taken to be the old intrusive model as has been described by Mallory.[12]

The spread of the Indo-European languages is thus related to the problem of the location of their original homeland. But as J.P. Mallory summarizes:

> Since the 19th century, attempts to resolve the problem of IndoEuropean origins have included evidence drawn from physical anthropology. This may be broadly divided into four traditions— pigmentation, cranial index, the correlation of physical types (based on multivariate analysis) and archaeological cultures, and genetics. None of these have satisfactorily determined the location of the Indo-European homeland.[13]

The various choices for the homeland of the different language groups is quite arbitrary. It is foolhardy to associate a language to a reconstruction of an ethnic type based on archaeological records.

If one considers the astronomical references in the Vedic literature, then one can postulate the presence of Indo-Europeans in Northwest India in the fourth millennium B.C. and earlier.14The priority of the Indic literature makes Northwestern India as another candidate for the homeland of the Indo-Europeans. But the question of the location of the homeland is in many ways an inappropriate question to ask with the current state of knowledge. The choice of the homeland and the original physical type is strongly correlated with the nationality of the proponent! Many North European scholars thus argued that the original Indo-Europeans were blond. It is not surprising then that most Western scholars did not consider Northwestern India as a viable candidate.

Whatever model one might choose, the relationship amongst the Nostratic languages is ascribed to proximity about eight thousand years ago. In turn these languages are taken to be derived from a yet earlier parent or to have picked up their shared characteristics from their early interaction.

The characterization of the Nostratic superfamily is based on the assumption that the relationship was defined at the pre-expansion phase. Such an assumption is inherent in a tree classification.

The search for a single superfamily of all languages is driven by the assumption that language arose only at one place. This hypothesis cannot be proved or disproved, so its discussion falls outside the purview of science. Since there do not exist any isolated populations there is no way to determine if the commonality being seen now is a result of historical interaction or is to be explained as a remembrance of the common origins.

In reality a tree classification is a misnomer. There is a further implicit assumption that the languages diverge from each other because their speakers are in societies undergoing different changes and are interacting with speakers of different languages.

ON LANGUAGE IDENTITY AND SOCIETAL PROCESSES

Societal processes and organization determine how long a language will maintain its identity as the speech of a minority group. Thus Murray Emeneau reminds us that Saurashtran

weavers in Tamil Nadu appear to have preserved their language for a period that could be more than a thousand years.

> After a period of at least fifteen centuries of migrations, Saurashtran still survives as the domestic language of the immigrant silk weavers of Madura. The historical events of their migrations were certainly very complex. The sequence, partly known from their traditions, brings them from Saurāṣṭra (Lāṭa-viṣaya) to Mandasor in Rajasthan prior to the fifth century A.D. (inscriptions there record the building of a temple in A.D. 437-438 and its repair in 473-474), then to Devagiri of the Maharashtran Yādavas (fl. thirteenth century), to Vijayanagar (Telugu-speaking; fl. fourteenth-sixteenth centuries), and finally to Madura. Whatever degree of exactness may be attributed to this tradition and history, the language certainly has traits that point to all the linguistic areas involved, but yet has been preserved over these many centuries of sojourn away from its place of origin. In every place the weavers were probably lower in the social structure than at least some of the neighboring communities (in spite of their present brahmanical pretensions), but there was no American-like pressure for total linguistic conformity with these neighbors.[15]

There are other examples that can be given from India. In contrast, minority groups have tended to lose their language within a generation or two in the United States. Language stability in India has been ascribed to stratification of society according to caste.

Nevertheless, languages will influence each other. The question to ask is: How might the encounter between two languages take place? The answer to this would depend on whether the two languages come face to face suddenly as would happen if invaders brought a different language or if two languages grow together in vicinity. In other words, the nature of the encounter depends on whether the languages meet as equals or if it is one-sided. For example, the interaction between Spanish and the American Indian languages has been one-sided. In a one-sided encounter the language of the conquering invaders is likely to be influenced little by the second language.

The similarities between Indo-Aryan and Dravidian are well known. It is interesting that one of these similarities, namely reduplication of words which is generally assumed to have been borrowed by Indo-Aryan from Dravidian, is also to be found in the European languages. Thus in English we have words such as pooh-pooh, choo-choo that have identical reduplication; examples of a different type are chitchat, chiffchaff, knickknack, riffraff, ticktack, zigzag, hodge-podge, and thingy-wingy. Reduplication in the Indian languages is much more common than in the European languages.

Considering the borrowings between Indo-Aryan and Dravidian, Emeneau says:

> [T]he languages of the two families, Indo-Aryan and Dravidian, seem in many respects more akin to one another than Indo-Aryan does to the other Indo-European languages.[16]

For this reason, India is considered a linguistic area with "languages belonging to more than one family but showing traits in common which are found not to belong to the other members of (at least) one of the families".[17] This indicates that the encounter between Indo-Aryan and Dravidian must have been a long and an equal one.

Nevertheless, the limitations of the philological approach are apparent if one considers that this analysis has led to the conclusion that the conservative caste system was adopted by the Indo-Aryans from the Dravidians. Emeneau says:

> We are almost forced to a hypothesis that the Dravidians whom the Indo-Aryan invaders met in the riverine plains of North India had a caste system with linguistic traits mirroring it, which they shared with the Dravidians of the plains of the south.[18]

This raises a thorny question. If the caste system and social stratification are to be invoked for the persistence of the Saurashtran language in South India for more than a millennium, and if the Dravidians had a caste system in the north before the arrival of the Indo-Aryans, then why was there no trace of the Dravidian language in the centuries before Christ in North India which was not too long after the supposed Aryan invasion?

At the same time scholars have argued that all ancient Indo-European societies had classes that might have been the forerunner to the caste system.[19]

But if the caste system was adopted by the Indo-Europeans from the Dravidians, then the original homeland of the two groups must have in proximity and they must have interacted amongst each other. Emeneau proposes that the North Indians themselves were originally Dravidian speaking and they adopted Indo-Aryan after a long period of bilingualism. But Emeneau's proposal does not have facts to back it. There are social practices and other features that show that Marathi speakers represent a region where bilingualism of Indo-Aryan and Dravidian was once prevalent. But such features are not to be found in the region of the Indus, Sarasvati, and the Ganga valleys.

The only way out is to question the traditional classification of the Indic languages and the models of their evolution.

A SCENARIO BASED ON CURRENT ARCHAEOLOGICAL EVIDENCE

The difficulty with most language classification models is that they do not do justice to the linguistic and archaeological evidence from the Indian suBCEontinent. To get over the contradictions where the current models lead us, one may propose the following scenario: Around 7000 B.C. the Indo-Europeans were located in the Indus-Sarasvati valleys, northern Iran, and southern Russia; the Afro-Asiatics were in West Asia; and the Dravidians were located just south of the Indo-Europeans in a belt stretching from South India to southern Iran. Their existed many trading links between the groups. The Vedic period is to be seen as following a long interactive era between the Indo-Aryans and the Dravidians.[20] The proof of this comes in many Dravidian features of the Vedic language.

This scenario does not address or answer the question as to the original homeland of

the Indo-Europeans or the Indo-Aryans. It has the virtue of explaining the astronomical evidence from the Vedic literature as well as explaining the deep structural commonality shared not only between Indo-Aryan and Dravidian but also between European languages and Dravidian.

This scenario also explains the striking resemblance between Vedic form
and a head unearthed at Nevali Cori in Anatolia by Harald Hauptmann.[21] The site of Nevali Cori dates to about 7500 BCEE. The striking thing about the head is that it is clean shaven except for a long tuft at the top that looks strikingly similar in style to the *śikhā* that a student wore in the Vedic times.

B.G. Sidharth[22] has taken this similarity to mean that this Anatolian civilization was Vedic. Our model, that considers the Indo-Europeans to be already spread from Anatolia to Northwest India at the time of Nevali Cori, is consistent with such an identification.

An important implication of our model is that there is no need to force the placement of events of the Vedic texts and the epics Rāmāyaṇa. and Mahābhārata, that are clearly defined by their contexts in Indian locales, to places outside India where they cannot be reconciled to other evidence.

CONCLUSIONS

The structural relationships amongst the Indo-European family of languages are well known. Not equally well known are the structural connections
between the Indo-Aryan, the Dravidian and the Munda languages. These languages may be said to belong to the Prakrit family of languages. We use the label "Prakrit" since it has been traditionally used to describe all Indian languages.

In other words, we argue that in general one might speak of membership of a language to more than one family. We believe such a usage is more accurate than the term "linguistic area" used earlier by Emeneau.

In recent years studies have been made to correlate genetic background of populations with languages.[23] These studies have had some success in describing the spread of languages. It is significant that on many counts the vast majority of the Indian population, in North as well as South India, is classed as a single group.

The evolution of the Prakrit family over millennia through prolonged interaction of the populations explains structural as well as biological commonality. The attested migrations of the Indo-Iranians into Europe explains the presence of several Dravidian features in the European languages.

NOTES

1. See for example Kak (1993).
2. See reviews such as Baldi (1983) and Ruhlen (1987).
3. Emeneau (1980).
4. See, for example, Baldi (1983), page 63.
5. Kaiser and Shevoroshkin (1988).

6. Ammerman and Cavalli-Sforza (1984).
7. Renfrew (1989).
8. Childe (1926).
9. For example see Shaffer (1992), Kak (1994a,b).
10. Kak (1987).
11. Gimbutas (1985).
12. Mallory (1992).
13. Mallory (1989).
14. Kak (1992, 1994a,b).
15. Emeneau (1980), p. 43.

16. Emeneau (1980), pp. 119-120.
17. Emeneau (1980), p. 1.
18. Emeneau (1980), pp. 237.
19. See for example Dum´ezil (1988).
20. See Kak (1994b) for details.
21. Hauptmann (1993).
22. Sidharth (1992).
23. See for example Cavalli-Sforza (1991), Sokal et al (1992).

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16
Indic Language Families and Indo-European*

As the science of language, historical linguistics in the early 19th century saw itself as providing a framework for studying the history and relationships of languages in the same manner as biology describes the animal world. But whereas biology has been revolutionized by the discovery of the genetic code, no similar breakthrough has brought new illumination to linguistics. Over the protestations of its many critics, mainstream historical linguistics has remained within the parameters of 19th century thinking. In the meanwhile, archaeological discoveries have altered our understanding of ancient Eurasia (e.g. Renfrew 1987, Feuerstein et al 1995). The Indo-Europeans are seen to be present in Europe a few thousand years earlier than was supposed before. The Indian evidence, based on archaeology as well as the discovery of an astronomy in the Vedas, indicates that Vedic Sanskrit is to be assigned to the 4th and the 3rd millennia BCE, if not earlier. The Indian cultural area is seen as an integral whole. The Vedic texts are being interpreted as a record of the complex transformations taking place in the pre-2000 BCE Indian society (Shaffer and Lichtenstein 1995).

But the whole edifice of historical linguistics related to the IndoEuropean family is based on the assumption that Hittite around 2000 BCE is the earliest member of the family and Vedic Sanskrit belongs to the period 1200-1000 BCE. A major effort is needed to put together a new framework to understand the pre-history of the Indo-European language family. In this note, I consider a few random linguistic questions of interest to the readers of *Yavanikā* that demand fresh examination.

LANGUAGE OF PARADISE

We all understand how the 19th century construction of the Orient by the West satisfied its needs of self-definition in relation to the Other. To justify its ascendancy, the Other was defined to be racially mixed and inferior; irrational and primitive; despotic and feudal. This definition was facilitated by a selective use of the texts and rejecting traditional interpretations, an approach that is now called Orientalism. The terms in the construction were not properly defined. Now we know that to speak of a "pure" race is meaningless since all external characteristics of humans are defined in a continuum. In the 19th century atmosphere of European triumphalism, what obtained in Europe was taken to be normative. With hindsight it is hard to believe that these ideas were not contested more vigorously.

Although this was the age which marked the true beginnings of modern science, old myths continued to exercise great power. When it was found that the languages of India and Europe were related in structure and vocabulary, the West responded with "a tissue of scholarly myths. These myths were steeped in erudition, informed by profound knowledge of

* Yavanika, Number 6, 1996, pp. 51-64

Hebrew and Sanskrit, fortified by comparative study of linguistic data, mythology, and religion, and shaped by the effort to relate linguistic structures, forms of thought, and features of civilization. Yet they were also myths, fantasies of the social imagination, at every level. The comparative philology of the most ancient languages was a quest for origins, an attempt to return to a privileged moment in time when God, man, and natural forces still lived in mutual transparency. The plunge into the distant past in search of 'roots' went hand in hand with a never forgotten faith in a meaningful history, whose course, guided by the Providence of the one God, could be understood only in the light of Christian revelation. As scholars established the disciplines of Semitic and Indo-European studies, they also invented the mythical figures of the Hebrew and the Aryan, a providential pair which, by revealing to the people of the Christianized West the secret of their identity, also bestowed upon them the patent of nobility that justified their spiritual, religious, and political domination of the world." (Vernant 1992)

Although the term Aryan never had a racial connotation in the Indian texts, the scholars insisted that this was the sense in which the term ought to be understood. It was further assumed that Aryan meant European by race. By doing so Europe claimed for itself all of the "Aryan" texts as a part of its own forgotten past.

The West considered itself the inheritor of the imagination and the mythic past of the Aryan and the idea of the monotheism of the Hebrew. This dual inheritance was the mark of the imperial destiny of the West. Despite his monotheism, the poor Jew, since he lacked Aryan blood, should have seen "the dark silhouette of the death camps and the rising smoke of the ovens." (Vernant 1992).

On the other hand, the Asiatic mixed-blood Aryan had no future but that of the serf. He could somewhat redeem himself if he rejected all but the earliest core of his inheritance, that existed when the Aryans in India were a pure race. For scholars such as Max Müller this became ultimately a religious issue. Echoing Augustine, Müller saw in his own religious faith a way for progress of the Asiatic. We would smile at it now but he said, "Christianity was simply the name 'of the true religion,' a religion that was already known to the ancients and indeed had been around 'since the beginning of the human race.'" (see Olender, 1992) But ideas– bad and good– never die. Müller's idea has recently been resurrected in the guise that Christianity is the fulfillment of Vedic revelation! (e.g. Panikkar, 1977).

A linguistic "Garden of Eden" called the proto-Indo-European (PIE) language was postulated. Europe was taken to be the homeland of this language for which several wonderful qualities were assumed. This was a theory of race linking the Europeans to the inhabitants of the original homeland and declaring them to the original speakers of the PIE. By appropriating the origins, the Europeans also appropriated the oldest literature of the Indians and of other IE speakers. Without a past how could the nations of the empire ever aspire to equality with the West?

Indian literature was seen to belong to two distinct layers. At the deepest level were the Vedas that represented the outpourings of the nature-worshiping pure Aryans. At the next level, weakened by an admixture with the indigenous tribes, the literature became a narrative

on irrational ritual.

SCIENCE AND PSEUDOSCIENCE

In scientific or rational discourse, the empirical data can, in principle, falsify a theory. This is why creationism, which explains the fossil record as well as evolution by assuming that it was placed there along with everything else by God when he created the universe in 4004 BCE, is not a scientific theory: creationism is unfalsifiable. Building a scientific theory one must also use the Occam's razor, according to which the most economical hypothesis that explains the data is to be accepted.

Bad intent should not turn anyone away from good science. Why isn't PIE good science? It looks reasonable enough: If there are biological origins then there should be linguistic origins as well. And why don't we believe that the nature of language tells us something about culture? If Europeans have been dominant in recent history, then why don't we accept it as a characteristic of the European? If Europe was dominant in ancient times then the origin of the PIE must be in the European sphere from where the energy of its early speakers carried them to the far corners of Asia and allowed them to impose their language on the native speakers.

There are several problems with the idea of PIE. It is based on the hypothesis that languages are defined as fixed entities and they evolve in a biological sense. In reality, a language area is a complex, graded system of several languages and dialects of a family. The degree of homogeneity in a language area is a reflection of the linkages, or interaction within the area. For a language distributed widely in the ancient world, one would expect several dialects. There would be no standard proto-language.

It is clear that language families belong to overlapping groups (Figure 1), because such a view allows us to represent better the complex history of the interactions amongst their ancestor languages. Such an overlap need not imply that the speakers of either group intruded into the overlapping region.

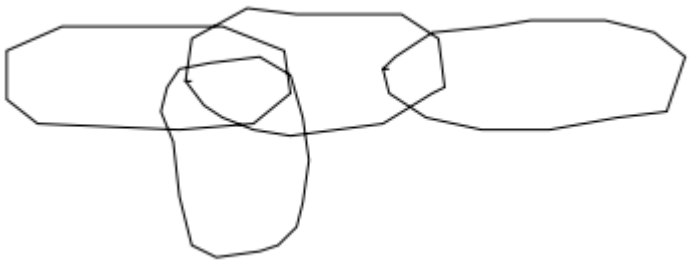

Figure 1: Overlapping language families

We note further the warning by N.S. Trubetskoy (1939) that the presence of the same word in a number of languages need not suggest that these languages descended from a common parent:

There is, then, no powerful ground for the assumption of a unitary Indogerman

> protolanguage, from which the individual Indogerman language groups would derive. It is just as plausible that the ancestors of the Indogerman language groups were originally quite dissimilar, and that through continuing contact, mutual influence and word borrowing became significantly closer to each other, without however going so far as to become identical.

The evolution of a language with time is a process governed by context-sensitive rules that express the complex history of interactions with different groups over centuries. The changes in each region will reflect the interaction of the speakers with the speakers of other languages (most of which are now extinct) and various patterns of bilingualism.

There is no evidence that can prove or disprove an original language such as PIE. We cannot infer it with certainty since the historically attested relationship between different languages could have emerged from one of many competing models. If one considers the situation that prevailed in the New World when Europeans arrived as typical, the ancient Old World had a multitude of languages. It is from this great language diversity that a process akin to biological extinction led to the currently much smaller family of languages. The metaphor of something perfect or pure leading to large diversity must be replaced by the metaphor of a web (Robb, 1993). This becomes clear when we consider biological inheritance: as we go back in time we have more and more ancestors.

The postulation of PIE together with a specific homeland in Europe or Turkey does violence to facts. There is no evidence that the natives of India for the past 8,000 years or so have looked any different from what they look now. The internal evidence of this literature points to events that are as early as 7000 years ago (Kramrisch, 1981) and its geography is squarely in the Indian region.

If there was no single PIE, there was no single homeland either. The postulation of an "original home", without anchoring it to a definite time-period is to fall in the same logical trap as in the search for invasions and immigration. Tree or animal name evidence cannot fix a homeland. In a web of languages, different geographical areas will indicate tree or animal names that are specific to these areas. When the European side of the IE languages are examined, the tree or animal names will favour those found in its climate and when the Indian side of the languages are examined, the reference now will be to its flora and fauna.

Colin Renfrew (1987) has pointed out how a circular logic has been used by linguists to justify what has already been implicit in their assumptions. Speaking of the work by Paul Friedrich (1970) on "Proto-Indo-European trees", Renfrew reminds us that the starting assumption there is that PIE was current in western Caspian and the Carpathians during the fourth millennium and the first centuries of the third millennium and then Friedrich proves that this was the PIE homeland! Reminds Renfrew:

> [Friedrich's] assumption is highly questionable. So complete an adoption of one specific solution to the question of Indo-European origins is bound to have a considerable impact upon his analysis of the origins of tree-names, and the historical

conclusions he reaches. It is scarcely surprising if his theory harmonizes with the historical reconstruction upon which it is based. It is perhaps reasonable that the historical linguistics should be based upon the archaeology, but that the archaeological interpretation should simultaneously be based upon the linguistic analysis gives serious cause for concern. Each discipline assumes that the other can offer conclusions based upon sound independent evidence, but in reality one begins where the other ends. They are both relying on each other to prop up their mutual thesis.

ARYAN AND DRAVIDIAN

It was Bishop Caldwell (1875) who suggested that the South Indian languages of Tamil, Malayalam, Kannada, and Telugu formed the separate Dravidian family of languages. He further suggested that the speakers of the proto-Dravidian language entered India from the northwest. Other scholars argued against this Dravidian invasion theory. Scholars have argued that this attempt to see both the North and the South Indian languages coming to the subcontinent from outside (West Asia) as another example of the preoccupation with the notion of the "Garden of Eden". In reality, the problem of what constitutes an Aryan or a Dravidian, in the biological or cultural sense in which it is generally posed, is insoluble.

The problem of Aryan and Dravidian is a conflation of many categories. Indian texts do not use the term Arya or Aryan in a linguistic sense, only in terms of culture. There is reference in the Manu Smr.ti where even the Chinese are termed Aryan, proving that it is not the language that defines this term. The South Indian kings called themselves Aryan as did the South Indian travelers who took the Indian civilization to Southeast Asia.

One may have posed the problem in terms of the anthropological 'distinction' between the speaker of the North and the South Indian languages. But the anthropologists tell us that there is no difference.

When linguists in the last century insisted that the term "Aryan" be reserved for the North Indian languages alone, it was inevitable confusion would emerge (Kak, 1994). The definition of Aryan and Dravidian are extrapolated from the culture of the speakers of the North and the South Indian languages. But the cultures of the North and the South are the same as far back as we can go. (There is some minor difference in kinship rules.) There is even a mirroring of the sacred geography. The North has Kashi and Mathura; the South has Kanchi and Madurai. Who is to say what was the original? If there is no cultural difference, then the use of the term "Aryan" as defining the culture of just the speakers of the North Indian languages is misleading.

This following example puts the absurdity of the terminology in focus. There exist texts that state that Tamilian Hindus came and settled in Kashmir in the early 15th century in the liberal reign of Bada Shah. We don't know how many people came, but that is the nature of such textual evidence anyway. Now what does that make a Kashmiri? An Aryan or a Dravidian?

Some scholars have claimed a Dravidian substratum for Marathi, but how do we know that prior that Dravidian substratum there was not some other language that was spoken there?

And maybe there has been more than one shift back and forth.

Let's imagine that everyone in India originally spoke Dravidian and then due to some process of "elite dominance" most people in the North started speaking Indo-Aryan and they kept their old traditions and legends. The new speakers will still be culturally Dravidian and certainly they would be so "biologically", if that could ever mean anything. If this is what happened in India then are the Aryans actually Dravidians and, by implication, are the Dravidians also Aryans? There could be two groups of people speaking two different languages who culturally belong to the same tradition like the modern-day Hungarians and Czechs.

We don't know who were the authors of the Vedas. They could have been bilinguals who knew 'Dravidian' and 'Vedic'; maybe their first language was really Dravidian even though they had Sanskrit names as has been true in South India for much of historical times; or they were purely Sanskrit speaking. No rhetoric or ideology can resolve this question.

The use of a language in literature does not even mean that the speakers are a dominant elite. Let's consider the use of Urdu in Pakistan. The Punjabi speaking Punjabis are the dominant group but Urdu is used for official work purely due to some historical factors. In fact, the only Urdu-speaking ethnic group in Pakistan, the Mohajirs, feel they are at the bottom of the totem pole.

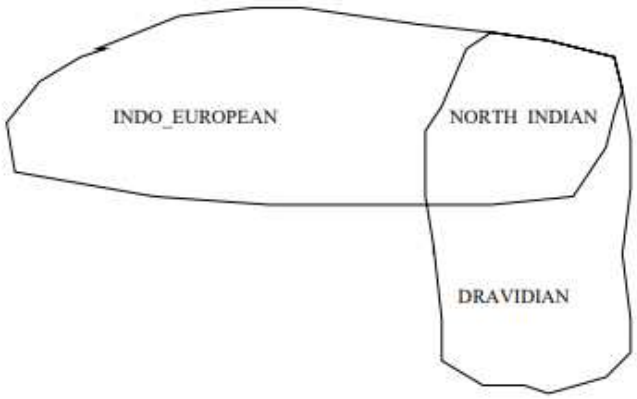

Figure 2: Indo-European and Indic families. The Indic family has the sub-families of North Indian and Dravidian

The texts cannot reveal the ethnic background just as Indians in the US who have adopted American names cannot be identified as ethnically Indian from their writing. The lesson is that the term "Aryan", misused by so many different parties, should be retired from academic discourse.

SEVERAL KINDS OF FAMILIES

The Indian linguistic evidence requires the postulation of two kinds of classification. The first is the traditional Indian classification where the whole of India is a single linguistic area of

what used to be traditionally called the Prakrit family. Linguists agree that based on certain structural relationships the North and the South Indian languages are closer than Sanskrit and Greek (Emeneau, 1980).

Second, we have a division between the North Indian languages that should really be called North Prakrit (called Indo-Aryan by the linguists) and the South Indian languages that may be called South Prakrit (or Dravidian) (Figure 2).

There is also the Indo-European family to which the North Prakrit languages belong. Likewise, Dravidian has been assumed to belong to a larger family of agglutinative languages.

This classification will allow us to get rid of the term Aryan in the classification of languages which is a good thing because of the racist connotation behind its 19th century use. Its further virtue is that it recognizes that language families cannot be exclusive systems and they should be perceived as overlapping circles that expand and shrink with time.

BACK TO ANCIENT INDIA

Some Indologists driven by the old race paradigm have stood facts upside down to force them to fit their theory. We know that the internal evidence of the Indian texts shows that the Vedas precede the Puranas. But since the Puranic themes are shown in the iconography of the Harappan times (2600-1900 BCE), the Puranic material is taken to precede the Vedas so that the Vedas could be placed in the second millennium BCE.

I think the only logical resolution of all the archaeological and textual evidence is to assume that the Indic area became a single cultural area at least around 5000 BCE. The Indian civilization was created by the speakers of many languages but the language of the earliest surviving literary expression was Vedic Sanskrit, that is itself connected to both the North and the South Prakrit languages.

This idea is supported not only by the internal evidence that shows that the Indic tradition from 7000 BCE onwards is an indigenous affair, but also from the new analysis of ancient art (Kak, in press). For example, David Napier (in press) shows how the forehead markings of the Gorgon and the single-eye of the cyclops in Greek art are Indian elements. Although he suggests that this may have been a byproduct of the interaction with the Indian foot soldiers who fought for the Persian armies, he doesn't fail to mention the more likely possibility that the influence was through the 2nd millennium BCE South Indian traders in Greece. This is supported by the fact that the name of the Mycenaean Greek city Tiryns — the place where the most ancient monuments of Greece are to be found— is the same as that of the most powerful Tamilian sea-faring people called the Tirayans.

GREECE AND INDIA

Since the 2nd millennium interaction between Greece and India is becoming clear only now, it is appropriate to ask if their languages were frozen into fixed categories wrongly by the 19th century historical linguists.

Consider the centum/satem divide in which Greek belongs to the centum group and the North Indian languages belong to the satem group. The old tree model is used to divide the PIE into these two sub-classes with the centum group representing the western branch and the satem group representing the eastern branch. The discovery of Tocharian as a centum language was seen as an example of heroic a movement of centum-speaking people from the west. But now the discovery of Bangani, a centum language in India itself has make the whole idea of a tree-like division suspect.

Consider also the question of our knowledge of the vocabulary of various languages. For some languages, this knowledge was primarily obtained in quick field-work done decades ago by scholars who were not native speakers. Could it be that they missed out on vital evidence?

Mallory (1989, page 114) informs us that the word *mori "seems originally to have meant swamp, marsh land or lake, rather than a large body of open water. [I]t is found only in European languages and not in Indo-Iranian other than Ossetic – an Iranian language contiguous to Europe although originating further to the east." This "fact" has lent itself to endless theorizing. But this "fact" is a result of incomplete surveys. The word *mär*, a cognate, is a common Kashmiri term for a swamp or even a lake. We see this word in the formation of *Kashyapmär* from which the word Kashmir is derived. Even Kannada has a cognate.

Also, many Hindi speakers pronounce the word for "hundred" as *sainkarā* rather than *saikarā*, which the field studies tell us. Does that make Hindi a centum language?

Certain assumptions regarding provenance and chronology were used to devise the vocabulary of PIE. The assumptions regarding chronology were shown wrong by the discovery that the Ṛgveda should be dated prior to at least 1900 BCE.

CONCLUDING REMARKS

The archaeological findings from India and the discovery of the astronomy of the Vedic period are fatal for the constructions of historical linguistics that arose in the 19th century and are still being followed in schoolbooks in India although textbooks in the West have begun to present the new picture. While the general language categories seem reasonable, the concept of overlapping families seems
essential to obtain better conceptual clarity. The Indic family is an example of such overlapping families.

The breakdown of the old paradigm calls for considerable effort to create a new one to take its place. In particular, the emerging chronological framework can be used to examine the relationships between Sanskrit and other ancient Indo-European languages. Etymological dictionaries should be revised to take note of the antiquity of Vedic Sanskrit. If PIE did not exist, can we extrapolate from the earliest layer of Vedic Sanskrit for correlations with life in prehistoric Harappan India?

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17
Sanskrit and Ancient Migrations*

INTRODUCTION

This essay is on connections between the languages of India and Europe, which are far apart geographically but belong to the same family. Recently, people have begun to use ancient DNA to see how India was populated by outside migrants and settlers.

It is quite fair to assume that people traveled in different directions in the ancient world but to effectively assume that a small number of migrants were able to change the language of India makes little sense, especially if this is proposed to have occurred as recently as 2000 BCE or thereabouts.

Why? Because we have literary evidence from India that speaks of continuity going back to about as early as 4th millennium BCE and these texts remember no other region but north and northwest India. We have astronomical references, datable geological events, king lists and lists of rishis that span several thousand years. One may dismiss one or two of these as myth, but one can't do so if the pieces are independent and connected with facts on the ground. Here's a summary (e.g. Kak, 2015):

1. Astronomical events in the Ṛgveda and later books are consistent and provide references to events that occurred in late 4th millennium BCE and subsequently in third and second millennia BCE. This is not only in terms of solstice and equinox information but also the very listing of the nakṣatras, which has a spread of several thousand years.

2. The memory of the Sarasvati River flowing once from the mountain to the sea, which was true latest around 1900 BCE and perhaps a thousand years prior.

3. When the Greeks came to India, they wrote about an Indian tradition of king-lists that went back several thousand years.

4. The acknowledgement in later books such as the Aitareya Brāhmaṇa that the Vedic people had moved beyond to the region west and northwest of India across the Himalayas to what is called Uttara Kuru, which is Bactria and the region of the Central Asian steppes and West Asia.

In the 19th century some scholars came up with the idea that the Indo-European languages were spread by the invasion of the Aryans by horse-riding warriors to India about 1500 BCE. This theory has been debunked time and time again but it takes on new forms. In

* Itihas Darpan (2021)

a new incarnation known as the "Steppe Hypothesis," horse-riding pastoralists from the Black and Caspian Seas migrated west into Europe and east into Central Asia and India around 3000 BCE.

It is most amusing that population theories take India to be a vast empty space, a big zero. Doing so may make a sensational news story for a day or two but it cannot square with hard facts. Even if we forget the texts, we have the archaeological evidence related to the nearly 10,000-year-old Sindhu-Sarasvati Tradition that shows India to have been the most densely populated region of the ancient world.

The density of the population makes it impossible to come up with a model where people from the sparsely populated steppes or the Iranian highlands will be able to change the language of the region.

A widely spoken language of a region is like an attraction basin in a complex system. The theory tells us that after any small perturbations the system returns to its old state. Even if one could think of a process that suddenly made a lot of people in the steppes decide to ride thousands of miles into the hot, baking plains of north India, they would, in a generation or two, lose their language unless they lived in small enclaves as isolated groups. If they did not even bring their women, as is claimed in one bizarre theory, their language, if different from the host language, would not survive a single generation.

Further ascribing successful replacement of language to superior technology of the chariot or the advantage of horsemanship does not change the argument.

Now it is quite possible that significant movement of people into India prior to 3000 or 4000 BCE, when the population of the Harappan settlements was not as large as it came to be later on, may have brought about change of the language. But this time-span is not convenient to many for whom the central issue appears to be the ownership of the Vedic literature and, even more importantly, its sciences.

Migration at such an early period will also have to explain why the injection of a large new population with a different language did not change the basic nature of the Sindhu-Sarasvati archaeological and cultural tradition. And where did these people come from?

If one takes ancient India to be effectively zero in population and uses ancient DNA only from regions outside of it, one can "explain" anything about later populations. This is a circular argument that is impossible to sustain in the light of the remembered history of the region.

Mathematical and physical arguments are easy to check for basic errors than those in the social sciences and history. You may not divide by zero, because if you did then you could show, for example, that $2 = 3$ (because $2/0 = 3/0$); likewise, any system that delivers more work than the energy it takes in is a logically impossible perpetual motion machine. Authors in the social sciences sometimes get carried away by ideas that are unfalsifiable or logically inconsistent and since these ideas are repeated in the echo chambers of the academia, it can take a generation or two, or even longer, to realize this.

Ancient bones hide as much as they reveal and they may not be representative of the populations of the region. This is especially true of India where most have traditionally

cremated the dead.

People hold on to ridiculous theories for they are not consistently rational and even Newton believed in the silly chronology that the world will end in 2016 or 2060. Irrational beliefs may be demanded for membership in academic, religious or political clubs.

The understanding of earliest India offered by the Indology community is based on flimsy philosophical and methodological foundations and a deep misunderstanding of the texts. Worse, it is a racist enterprise in which the stated objective is to teach Indians what their books mean. Its premise is that Indians are culturally backward, they never developed scientific or critical thinking, and they lack access to the "true" meaning of their texts. It is further implied that the original authors of the ur-texts, which over the millennia have expanded into voluminous tomes with what they say have internal contradictions, were outsiders like the Indologists themselves, and the current confusing state of the texts reflects cultural shortcomings of Indians as a consequence of the intermingling of the original Indo-Europeans with the lesser races of India! (Adluri and Bagchee, 2014)

In private conversations with academics who work on India, there is acknowledgement that there is a cabal that consists of racists, European supremacists, leftists and others who might be sincere but so marinated in an obviously wrong paradigm that they don't even know they are wrong. And then, of course, there are the thick-headed ones who just don't get it; one of those once wrote me an email saying that only "philologists have the authority to interpret ancient India."

PIE AND ITS HOMELAND

In the 19th century, linguists came up with the idea that nearly all modern European languages are descended from an ancestor language called Proto-Indo-European (PIE), which they proposed was spoken prior to about 3500 BCE. The idea of PIE was to play a powerful role in recent world history.

Inspired perhaps by the Biblical notion of an original language of the Garden of Eden, linguists labored to reconstruct the vocabulary and grammar of PIE, and for this they used theories related to sound shifts and certain ideas about the antiquity of languages. A lot of "analysis" went into finding the original homeland of PIE, and it was usually located in Ukraine or Southern Russia.

A linguist named August Schleicher even created a fable called The Sheep and the Horses in imagined PIE to amuse himself and future generations of students.

The philologist Arthur de Gobineau argued that the languages of Europe were closest to PIE, marking the Europeans for superior character and access to scientific knowledge. From there the special role ordained for the Europeans in maintaining colonies in Asia, Africa and the Americas was not a big jump. British historians saw the British Empire as historic fulfillment of a divine mission.

Trying to outdo the English and the French who had shut them out of the closed markets of their colonies, the Nazis in Germany declared that they were the master race, inhabiting a region not far from the homeland of the PIE. Academics with minds marinated

in 19th century racism continue to spin the most fanciful derivations of PIE words (Renfrew, 1987).

All right, it is sad history. Shall we say it was a good idea that was put to evil ends by unworthy people? That doesn't make the theory wrong, or give us license to announce the death of PIE.

PIE as generally understood considered the original homeland to be somewhere in Europe, north of the Caucasus, and it assumes a certain time span, considerably before the time for which we have records.

The first substantive records in any IE language are in Sanskrit. The earliest period from which we have these records is conservatively taken to be 2000 BCE and in fact could be half a millennium older if we consider the astronomical evidence within the Vedic books, which has become properly understood only in the recent decades.

Furthermore, the conservative date for the drying of the Sarasvati River, the preeminent river of the Ṛgveda, extolled as going from the mountain to the sea (RV 7.95.2), is seen as 2000 BCE. There is much additional evidence related to the continuity in the arts and culture and the remembered tradition. The idea of PIE requires antiquity much greater than that of the Vedas.

New research calls into question both the elements on which the idea of PIE stands. In one recently reported research, bones of 45 ancient humans from the Caucasus region, from a period some of which are as late as 2500 BCE to 1200 BCE, were analyzed for their DNA. The research showed that these ancient people moved predominantly from the south to the north. This indicates that the IE languages perhaps arose south of the Caucasus Mountains, spreading to other parts of Europe as people migrated north from this region.

If PIE lay south of the Caucasus and Indo-European (IE) languages in Europe are much younger than presumed before (and as late as 2000 BCE) then there is no period that can be assigned to a hypothesized parent language, and PIE is dead.

MORE ON PIE AND ARCHAEOLOGY

If the periods necessary for the evolution of modern IE languages from PIE are no longer supported by the evidence, and if there was no PIE, we must accept some other process, perhaps an amalgam of diffusion with movement of people as the lesser vehicle that led to the spread of IE languages.

PIE is based on analogies and models from the hard sciences that do not apply to language. Contrary to what is assumed in PIE, the scientific study of genetics (a field that arose after the naïve genetic notions of philology had become frozen) tells us that diversity arises out of the complex relationship between the genes of a large host population and not from a family of uniform characteristics.

The diversity of the languages around 4000 or 5000 BCE, the period when the PIE speakers are supposed to have lived in their homeland, is likely to have been much greater than the subsequent period, just as was seen in America when the Europeans arrived.

The identification of the PIE homeland was based on a selective use of words of the supposed common vocabulary of the IE languages. It was suggested that since there are common words for many blood relatives, and not the same number for in-laws, therefore in the original society the relationship with the in-laws was not close. Going by this method, the people in the homeland knew butter but not milk, and snow and feet but not rain and hands.

This is not all. A certain chronology was assigned to the oral texts, and then certain changes were postulated that agreed with the assumed model. In circular reasoning, these changes were now taken as the proof that the model was correct. The logic was somewhat like a fisherman using a net of a certain cross-wire size and then arriving at the inference that the lake has no fish below that size.

An attempt to connect archaeology to PIE was made by Marija Gimbutas in her kurgan hypothesis. She traced the language back to the Yamnaya people, herders from the southern grasslands of modern-day Ukraine, who domesticated the horse.

But new research suggests that around 2500 BCE, Yamnaya genes replaced about seventy-five percent of the existing human gene pool in Europe. This is very late, and it leaves no room for the development of a PIE within Europe.

EVIDENCE FROM INDIA

The evidence from India provides a picture quite consistent with the facts that have emerged.

The earliest geography known to the Ṛgveda is the region of the Seven Rivers in Northwest India, but this does not rule out the presence of related languages beyond the borders of India. Our knowledge of Vedic astronomy shows that the earliest remembered period in the hymns comes from late 4th millennium or early 3rd millennium BCE, which is prior to the supposed entry of the IE languages into Europe.

Later books, such as the Aitareya Brāhmaṇa, which belong to the 2nd millennium BCE, speak of the expansion of the Vedic religion into regions called Uttarakuru and Uttaramadra beyond the Himalayas to the northwest. Aitareya Br. 8.14 says Uttarakuru had Vedic consecration for their kings. Ptolemy knows of these regions as Ottorokorrha and describes them lying between the Aral and the Caspian Seas and Megasthenes and Strabo are emphatic that the Uttarakuruvah [Hyperboreans] are connected with the Indians.

In a recent essay, I provided evidence of the connections between India and the Slavic world through the mediating agency of Uttarakuru (Kak, 2020), and it is likely that from them certain ideas were passed further on to the languages of north and south Europe.

There is also evidence of the interaction between the Vedic people and West Asians through the Mitanni Empire, which, in turn, explains many commonalities between the Sanskritic and the Semitic worlds.

A reasonable way to understand the spread of IE languages is through the process of diffusion together with some movement of people in a manner that is not so different from the spread of Indian culture in Southeast Asia.

PIE was based on many fanciful assumptions. From a logical point of view, its proponents forgot that it is not enough to show that a reconstructed (and imagined) PIE, A*,

leads to languages B, C, and D, but that the derivation excludes all other reconstructed languages. One must be able to exclude reconstructions such as L*=> C => B => D or M* => D => C => B and any number of permutations thereof.

This simply cannot be done, and so the PIE reconstruction is simply worthless, and just one of any number of similar reconstructions one can develop.

In retrospect, we cannot say that the labors of the linguists who created it were no worse than that of the scholiasts in the Middle Ages who determined how many angels can be accommodated on the tip of a pin. Because of the wars and violence that PIE has engendered, it should be compared to the similarly sloppy reasoning that led Europe, over the course of a century and a half, to try 80,000 people for witchcraft, half of whom were executed, and often burned alive. It is easy to make logical errors when implicit assumptions are not examined. Grief ensues when such errors form the basis of a polity or a state. Just think of the vast suffering unleashed by the communist ideology, which is based on simplistic ideas about human nature.

DIVERSITY

Nikolai Vavilov (1987–1943) was a brilliant agronomist and geneticist whose ideas helped identify geographical areas where specific modern plants developed their distinctive properties. The areas where domestication occurred first have generally continued to have the most diversity. Examining the diversity now helps us confirm that the origin of potato is Peru, that of sugarcane is India, and that of soybean is China.

Although Vavilov's work was exceptional, his life was tragic. He was on the wrong side of the scientific orthodoxy of Communist Russia as articulated by Stalin's favorite biologist Trofim Lysenko. For opposition to this incorrect scientific creed, Vavilov was arrested and sentenced to death in July 1941. The sentence was later commuted to twenty years' imprisonment, but he died of starvation in prison in 1943.

The idea of domestication of a plant is similar to the first development of a literary language. We would expect that the area in which a language came to have its distinctive form will have the most diversity of names.

Sanskrit is exceptional in that it has many, many synonyms for common words and in that it is quite different from other languages that belong to its family. Here is just an example of diversity for a few notable words compared between Sanskrit and various European languages.

House

आवास, āvāsa — haus (German)

दम्, dam — дом or dom (Russian), domus (Latin) => domicile, domestic, democracy

गृह, gṛha — kaha => casa (Latin), casa (Spanish) => Casanova, Kasaba (town)

खानि, khāni mine (enclosed space) — khane خانه (Persian); वसुखानि, Vasukhāni, the home of wealth was capital of the Mitanni Empire

Amarakośa has over twenty names for house. One of these even throws light on the word harem (Arabic: حريم ḥarīm, "a sacred inviolable place"). With exactly the same meaning, the word harmyam हर्म्यम् appears 12 places in the Ṛgveda (including RV 1.166, RV 7.55, and RV 7.66). It is the secure and pleasant part of the palace that consists of many rooms where women and children reside. The root of the word is √hṛ which means captivating.

Water

कः, kah — aqua (Latin) => agua (Spanish)
वारि, vāri — water (Dutch)
उदक, उद, uda — voda (Slovak)
आपः, āp — آب āb (Farsi), apă (Romanian)
नीर, nīra — νερό (neró) (Greek), dŵr (Welsh)
The words पानी, पेय (pānī, peya) and variants mean "drink"; जल, jala means fluid.

The range of names for water and how it appears to cover the entire European continent is simply mind-boggling.

Mountain

फलिक, phalika — berg (German) from a transposition of consonants in their class labial (ph -> b), semivowel (l -> r) and velar (k -> g) as is common (for example in raghu -> laghu)
बलाहक, balāhaka — berg (German) (another derivation)
शैल, śaila — fjell (Norwegian)
मन्दर, mandara — मन्त्, mant => munte (Romanian) => mountain (English)
गिरि, giri — gora (Russian)
मस्तक, mastaka — summit as in Sagaramastaka => Sagarmāthā सगरमाथा, the Nepali name for Mt Everest.

Earth

अर्ध, ardha (region) — erde (German)
धरा, dharā — terra (Italian)
क्षमा, kṣamā — ziemia (Polish), zeme (Czech)
गो, go, gauh — gaia (Greek)
भूमि, पृथिवी, मही, मेदिनी and over fifty other names.

Sky

ख, kha, सगर, sagara— sky (English)

नभ, nabha — nebo (Croatian, Russian), nebe (Czech)

अश्मन्, aśman (sky vault) — āsmān (Farsi), sama (Arabic) => hama => himmel (German)

केलि, keli (heaven as pleasure place) — caelum (Latin), cielo (Spanish), ciel (French)

वरुण, varuṇa (from vṛ, to surround) — ouranos (Greek)

आकाश, ākāśa — gökyüzü (Turkish)

Divinity

देव, deva (point of light) — dio (Italian), theos (Greek), dios (Spanish)

स्वतव, sva-tava (self-powered) — xwatāw (Avesta), xudā, to Khudā (Farsi), and via Iranians to German Gott and English God.

Note: tavas तवस् (a. strong, great. -n. strength, power) (बल). In the Ṛgveda सोमस्य मा तवसं वक्ष्यग्ने RV.3.1.1. tavasya तवस्य a. increasing strength (as an oblation). -स्यम् strength; तस्मै तवस्यमनु दायि सत्रा RV.2.2.8. svatavas: inherently powerful, self-strong. Some see हुत, huta -> God, but I don't find that plausible.

भग, bhaga (blessed one) — bog (Russian), boh (Ukrainian)

इष्ट, iṣṭa — isten (Hungarian)

इला, ilā — Allā (Maltese)

तनुगृहिन्, tanugṛhin (the lord of the first lunar mansion) — tanugri => tengri (Turkish). Note: The term for the lord of the first lunar mansion in the sky was equated with the sky.

तन + गिरि = expanding mountain from √tan = expand has also been proposed for Tengri. The Indic and the Turkic and Mongolic languages were in contact through the post-Vedic regions of Uttara Kuru and Uttara Madra in Central Asia.

Sanskrit श्वेत "śveta" => Slavic root "svet (Cyrillic: свет) = light, shining, bright, or holy.

The Chief Slavic divinity was the four-headed Svetovid (the knower of light) श्वेतविद्, with its four faces: Northward is Svarog स्वर्ग, westward is Perun पर्जन्य, southward is Lada, Laḍaha लडह (Earth Goddess), and eastward is Mokosh मोक्ष (Kak, 2020).

Sanskrit has dozens of additional names for divinity that include ईश्वर, Īśvara.

Hero

वीर, vīra — eroe (Italian), geroy (Russian), held (German)

भगपुत्र, bhagaputra (son of divinity, brave) — baghpūr (Sogdian), Баатар Bātar (Mongolian), Bağatur, Baghatur Batur, Bahadır (Turkish), Bogatyr (Russian); Bohater (Polish); Bátor (Hungarian); Bahador (Farsi); بهادر (Arabic), बहादुर (Hindi)

युवक, yuvaka — junak (Slovenian)

क्रोधमन्त, krodhamanta (krodhamantra is attested)— could be the origin of kahraman (Farsi); another possibility is गहन gahana -> gahara (attested) -> kahara -> kaharman.

शूर, विक्रान्त and many more.

Caesar and Kesarī

Indian kings used the title Kesarin केसरिन् or Kesarī (for lion), and a dynasty that ruled in east India for three centuries was called Kesarī. The title Kesarī was used in India in the same manner as the Roman Caesar (Latin pronunciation = ˈkaɐ̯sar) from which Kaiser (German) and Tsar or Czar (Russian) are derived. There is no evidence that the usage in India was a borrowing from Rome.

Pliny derives Caesar from caesaries or "full head of hair", because the future ruler was born thus. The word was elevated to a title after Caius Julius Caesar (100 BCE — 44 BCE) became dictator and later it was used by emperors down to Hadrian (138 CE).

In Sanskrit, the word kesarin (having a mane) comes from the word kesara, one of whose meanings is hair. Male lions, horses and some monkeys have mane, so each of them can be called by this word. In passing, Sanskrit śravas श्रवस्, swift, could very well be the origin for "horse". Incidentally, Indra's horse is named Uccaiḥśravas, "exceedingly swift".

In the plant kingdom, kesara refers to filament of any flower and thus to saffron. But mostly Kesarī केसरी means a lion. An equivalent title in India that was used by kings is that of Siṃha सिंह, which is familiar to all in the spelling "Singh". In the Rāmāyaṇa, the father of the hero Hanuman is Kesarī.

The correspondence between Sanskrit and Latin for this word is quite striking. Is it just the word derived from the non-existent mother language or obtained through diffusion? We know that there was commerce between ancient India and Rome so the idea of diffusion in both directions cannot be ruled out.

The city and the land

Now we come to the names of the city in Sanskrit, which could also be a place, a fort, an enclosure, and so on.

उम, uma (town) — Umā (of the Mountain [City])

उरु, uru (wide protected space) — var (fort, Iranian); oras (name of town in Romania and Moldova)

कीला, kīlā (stake) — the basis of किला, kilā (fort)?

कर्वट, karvaṭa (capital of 200 to 400 villages, city, that needs common law) — civitus (Latin) pronunciation: kiːwɪtaːs), was the social body of the cives, or citizens, united by law (concilium coetusque hominum jure sociati); citta (Italian); city (English)

कोट, koṭa (fortress) — as in Rajkot. Kot (کوت) is a district in the northern Nangarhar Province of Afghanistan. A kot is a type of privately rented rooms during the academic or school year in Belgium.

ग्राम, grāma (village) — Gurugram.

क्षा, kṣā(abode) — kṣatra क्षत्र (power) => Khotanese, kṣāra => shahar (Persian), shire (English)

गर्त, garta (high enclosed place) — गढ, gaḍha (fort) — gorod (Russian)

देश, deśa (region from diś, direction) — Bangladesh

दुर्ग, durga (fort) — Ilādurga (name of a place), Durg district

नगर, nagara (city) — Srinagar in Kashmir

पट्टी, paṭṭī (town) — पट्टनिवसन (a town-dweller)

पत्तनम्, pattanam (town, city) — Vishakhapatnam in Andhra Pradesh

पल्लि, palli (town, city) –Tiruchirappalli, Maṇipalli

पुर, pura (fortified city, citadel) — polis (Greek), Heliopolis in Egypt, Persepolis in Iran, Sevastopol in Crimea, Indianapolis in USA

पाद, pāda (quarter; as in Viṣṇupāda) — -bād or -ābād (آباد), meaning cultivated place (Farsi), Ashgabat in Turkmenistan, Abbottabad in Pakistan

बिल, bila (cave) — ville (Latin) for farm and later village, as in Louisville in Kentucky; byr (farm, town) in Norwegian

भर्ग, bharga (bright place)– borgh (Old Swedish). Borg is a German village in the municipality of Perl, Saarland

राण्ड्य, rāṇḍya(agreeable [country]) — RV 6.23.6, we know of the transposition between "l" and "r" as in lekhā and rekhā=> lāṇḍya=> land (English)

वाट, vāṭa (enclosure) — As in Angkor Wat (Cambodia)

वेष्टन, veṣṭana (enclosed) — (also note the "v" to "m" transposition in Sanskrit as in varma and marma) — mesto (Czech, Slovak, Slovenian), Staré Město in Czech

Republic

स्थान, sthāna (place, land, city) — stāna (Hindi) as in Londonistan or Gamlastan in Stockholm, Stanmore in UK; -ston => -ton as in Paddington (UK)
स्थल, sthala (land) — -ster, as in Lybster in UK
स्थात्र, sthātra (station, land) — stadt (German), Hampstead in UK
स्वतन, svatana (own land) — hvatana (Khotanese) => vatan (Kashmiri, Turkish)

and there are many more words for town and city in Sanskrit.

The above list, which is by no means exhaustive, show that many different words were used for the city in different languages of Europe. That this diversity is subsumed in Sanskrit goes counter to the standard picture of the Indo-European family in which just one group went from its Urheimat towards India.

TWO HYPOTHESES

To explain this diversity of names in Sanskrit the following two hypotheses may be advanced.

The first hypothesis is like that of Creationism according to which God created Earth in 4004 BCE together with all fossil record. Different European tribes at different times managed to lend their words to the Indians. They did so by invading India and then making sure that the ancient Indians, who are notoriously conservative, dutifully used these diverse words in their hymns and texts so that none was forgotten. Even though the invaders were few, the native Indians submitted to the superior European language and religion. Clearly this hypothesis is unfalsifiable and lies outside the domain of scholarly discussion.

The second hypothesis is that Sanskritic languages went out from Greater India via Central Asia to Europe and also by the sea route. This out movement, which was primarily a process of cultural diffusion, continued over centuries and in this process different tribes held on to the words that were more common at their time of dispersal. The migration is hinted in the Puranic texts and the record exists not only in the Central Asian languages but also Slavic, Lithuanian, and other European languages. Since cultural diffusion was a big element of this dispersal there need not be a direct correlation between ancient DNA and language.

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18
The Notion of India*

The moon in the water, broken and broken again, still it is there. — Ueda Chōshū

INTRODUCTION

What is the notion of India? In its remembered geography, it is north of the sea and south of the Himalayas, as in the Viṣṇu Purāṇa:

> उत्तरं यत्समुद्रस्य हिमाद्रेश्चैव दक्षिणम् ।
> वर्षं तद् भारतं नाम भारती यत्र संततिः ॥
>
> *uttaraṃ yat samudrasya himādreścaiva dakṣiṇaṃ/*
> *varṣaṃ tat bhārataṃ nāma bhāratī yatra santatiḥ//*
>
> North of the great ocean, and to the south of the Himalaya, is [the land of] Bhāratavarṣa where the descendants of Bharata live. --*Viṣṇu Purāṇa*, 2. 3. 1

While heartland Bhāratavarṣa (= Bhārata) lay below the Himalayas, ancient rishis considered Uttarakuru to the north also a part of the Vedic world, and Aitareya Brāhmaṇa 8.14 says that this region had Vedic consecration for their kings.[1]

But let's return to the statement in the Viṣṇu Purāṇa that in Bhāratavarṣa, the land south of the Himalayas, live the Bhāratas. Are we to take the Bhāratas to mean the descendants of the legendary Bharata, who the Mahābhārata tells us was Bhārata's first emperor? The Bhāratas are a prominent clan in the Ṛgveda as a sub-clan to the Purus, but there is no mention of Emperor Bharata there. He is first mentioned in the Ādi Parva of the Mahābhārata, where he is the son to King Duṣyanta and Śakuntalā.

There are many other Bharatas in Sanskrit literature. According to the Varāha Purāṇa chapter 74, Bharata is a descendant of Svayambhū Manu; it is also the name of the author of the Nāṭya Śāstra; and there is a Bharata who is ancestor of King Rāma, whose own younger brother has the same name.

Bharata is a name of Agni, of Rudra, and of one of the Ādityas. Speaking of Agni, we must remember that it is symbol of speech[2] (that codes knowledge), and so it is not surprising that Bharata is the "actor" who must maintain (*bhṛ-*) the act, or is absorbed (*-rata*) in the light (*bhā-*) of the role. According to some scholars, the actors and singers (Bhāratas) spread Vyāsa's epic to the far corners of the land so that it became the Mahābhārata.

Whatever the origins of the usage of the name, Bhārata as *bhā* + *rata*, "[people who are] absorbed in light, or wisdom" seems to be the best fit for how others see India. Whether

* Medium and Academia.edu

united or divided into warring kingdoms, the land was seen as storehouse of spiritual and scientific knowledge. Even now, when outsiders travel to India, they do so to learn from yogis, musicians, artists, and modern rishis.

Presently, there is a contest between two views of India which plays out daily in the media and Indian politics. This contest springs from India's colonial history and drive for freedom. It is a contest between two different experiences and visions.

> *Take up the White Man's burden–*
> *Send forth the best ye breed–*
> *Go, bind your sons to exile*
> *To serve your captives' need;*
> *On fluttered folk and wild–*
> *Your new-caught sullen peoples,*
> *Half devil and half child.*
> – Kipling, The White Man's Burden

On the one side, are those who believe in the old British idea of the *White Man's burden* of saving India from its backward culture. Kipling, like most other British, saw the Raj as essential to maintain order and peace amongst the "heathens". Oblivious to the ruination their policies had caused,[3] the British believed they were helping relieve famine, bring order and laying the physical and the psychological groundwork for civilization. Their ideas mirrored prevailing Western political, racial, moral, and religious beliefs and they saw their own culture to be superior with a moral responsibility to the uncivilized world.

The Indian inheritors to the mantle of Kipling and the officials of the Raj are in general agreement with the above excepting that the narrative is expressed in a coded way. They want to jettison Indian culture, and they mock Indian festivals, the practice of pilgrimage to rivers, and the reverence of nature. Most of all, they hate Sanskrit for they believe it represents a connection to the past that needs to be severed as soon as possible. Their disdain extends to other Indian languages, whose use, they contend, should not be for anything beyond what is needed to communicate with illiterate folks engaged in menial work. These people speak in English with other Indians, even if they don't know the language well. Hilariously, most Bollywood actors respond in English on TV interviews when the question is put in Hindi. They believe there is nothing worthwhile in India's own culture and they take their cues from opinion makers in the West. They accept the colonial construction of India as a regressive place that must be redeemed with the help of the West.

On the other side are those who also swear by modern science and technology while maintaining that Yoga, spirituality, Indian literature, sciences and music are of continuing relevance, consistent with the notion of India as Bhārata, a land devoted to knowledge. They believe that the knowledge in India's own intellectual tradition is too valuable to be ignored. They also believe that abandoning Indian languages in sciences and other societal work is only going to slow down development and progress.

THE COLONIAL IDEA OF INDIA

The old idea of India emerged from the work of British colonial administrators and European scholars motivated by the demands of the Raj, pseudoscience and racial prejudice. The British dismantled India's schools[4] and created a new system of colleges and universities using English as the medium of research and instruction. Their understanding of India was imperfect quite like someone claiming to know Britain while ignorant of Shakespeare and Shelley, Austen and Dickens, or Darwin and Dirac. The British ruled the narrative; Indian classics were thrown out, and Indians could enter the academy only on the terms set by them.

The British destroyed India's economy in the name of reformation that dispossessed nearly every class.[5] They saw imperialism not as disruption, exploitation, or subjugation, but as economic development and moral enlightenment for India. They viewed India as mirror image of what is inferior and alien to the West. This Indian was a single image, a sweeping generalization, and a stereotype that erased all diversity.

To provide justification for colonial rule, the British declared that Indian society was pre-rational and it needed guidance by Western ideas. Depicted thus in textbooks at all levels, Indians slowly came to believe this characterization, and this included many nationalist politicians and intellectuals who came to positions of power after Independence.

There were two main elements to this idea of India:

> *One:* India is a land divided by rigid caste and hierarchy and its social and intellectual history must be seen within this framework and as an encounter between different races.
>
> *Two*: Indian society is deeply conservative and religious and it has no real tradition of science, arts and innovation. There may have been some innovation in mathematics, architecture, and philosophy, but it was done by outsiders who were descendants of invading or migrating groups. India has received most of its worthy ideas from the west and the north, and this includes writing.[6]

After the British departed, the education, administrative, and political ecosystem remained tethered to this idea. There was challenge to it from scholars who knew Indian texts and by subaltern groups, but they were mocked and ridiculed. Scholars are aware that the idea of India conjured up by during the British Raj is false, but they are opposed by others in the academy who are driven by Eurocentrism[7] and prejudice. Astonishingly, some have even resorted to fabrication of evidence in support of the old view.[8]

> *Spring is passing, the birds cry, and the fishes fill with tears on their eyes.*
> — Matsuo Bashō

CASTE IN INDIA

Many will be shocked to discover that the modern idea of caste is a colonialist construct.[9]

There is no synonym for caste in any Indian language. The word 'caste' comes from the Portuguese *casta*, a word that was meant to describe the jāti system that is composed of clan or occupation based communities, but slowly it has come to have a much broader connotation.[10] The term was conflated with varṇa, which is a theoretical classification based on social class.

India's jātis represented a fluid system, not too dissimilar from that of other cultures. As people migrated from one region to another, they often changed occupation or were identified with a different class. There was also powerful religious sanction to the idea that varṇa, as representative of the class one fitted in best, was based on temperament rather than birth.

To get context for what was happening to the jātis, one should remember that the British destroyed India's economy by crushing taxation and preventing investments in India just as the industrial revolution took off in Europe. India rapidly became deindustrialized and turned into a destination for British goods. This was great for the Empire but a disaster for India. The horror of that period may be guessed from the estimate that India's share of the world manufacturing fell from 20% to about 1.4% during the British rule[11] (the estimate is for 1750 -1914).

The dynamics between the jātis was influenced a great deal by historical and political factors. During the periods of economic growth, the jātis have been relatively open-ended; during periods of hardships the jātis have tended to draw in for the sake of survival.[12]

Colonial anthropologists failed to understand the complexities and fluidity of the jātis. The classification in terms of these castes was used to categorize people in the census forms in 1872. Most jātis were not aware of the specific varṇa class they were supposed to belong (for no such mapping existed) but were squeezed into the varṇa system by the British administrators.[13]

Based on his understanding of the 1872 Census, the British administrator Denzil Ibbetson argued[14] that jātis were a social rather than a religious mechanism for those who had converted to Islam also had it. He insisted that varṇa categories of Brāhmīn, Kshatriya, Vaishya and Shudra did not correspond to reality. He thought that the Kshatriya likely no longer existed and Vaishya certainly did not. There were classes of Brāhmīns who were viewed as outcastes even by the lowest ritual rank, the Shudra, and that the latter term was primarily used as a form of abuse rather than in any categorical sense.

But the ideas of racism were very strong and the perfect fit for the colonial project in India. Missionaries, anthropologists, and government officials set about identifying and classifying Indians into different castes.[15] They used head measurements, skin color, physique, and occupation to develop a racial theory of Indian civilization.

The British Superintendent of the 1921 census summarized what they had done over the previous half-century:[16] "We pigeon-holed everyone by caste and if we could not find a true caste for them, labelled them with the name of hereditary occupation. We deplore the caste system and its effect on social and economic problems, but we are largely responsible for the system we deplore."

Some jātis were declared to be martial and therefore fit to serve in the army, others were left with menial jobs, and yet others were labeled criminal. The British created a system of institutionalized discrimination. Slowly, the jātis that came out on the top in this classification began to believe in the myth of their superiority since immemorial time. These false ideas have poisoned politics for over a century in the entire Indian subcontinent.

Think about this: H. H. Risley hoped to demonstrate that the social status "varies in inverse ration to the mean relative width of the nose" and that "intelligence is in inverse proportion to the breadth of the nose."[17] People were discouraged to apply for clerical jobs if their nasal index exceeded a certain number.

The historian Thomas Trautmann considers H.H. Risley, who became Census Commissioner in 1899, along with the philologist Max Müller, to have most aggressively pushed the idea[18] "that the constitutive event for Indian civilization, the Big Bang through which it came into being, was the clash between invading, fair-skinned, civilized Sanskrit-speaking Aryans and dark-skinned, barbarous aborigines." Their influence is not entirely gone. Some of the most racist scholars are to be found in the Indology and Sanskrit departments of the West.

INDIA AND SCIENCE

Writing in 1068, the Spanish-Arab scholar Said al-Andalusi declared in his book *Ṭabaqāt al-'Umam* (Categories of Nations) comparing the science of the leading nations that Indians were the most advanced:[19] "The Indians are the essence of wisdom, source of fairness and objectivity. They are the peoples of sublime pensiveness, universal apologues, and useful and rare inventions."

The British administrators in the education system were generally ignorant of India's history of science so they did not accept this characterization,[20] even if they acknowledged that the Indian schools were able to impart basic education to broad segments of society, irrespective of their jāti. Macaulay famously stated that Indian knowledge was worthless and reason enough to separate Indians from their traditions and books, and this became a cornerstone of their education policy.

It is now well accepted that India has been one of the leading scientific nations of the world,[21] and it has supplied the foundational bases of modern science.[22] Nevertheless, this material is generally unknown to the layperson (especially in India where the curriculum is still controlled by the colonialist vision) and therefore old myths persist.

An aside on why I ever got into the study of the history of Indian science. In the eighties, I happened to see a paper which argued that if there was something in Indian scientific texts that was not to be found in Greek or Babylonian texts, then it should be taken as an example of lost Greek or Babylonian knowledge. The fact that such an illogical hypothesis was taken seriously in the academy got me hooked into investigating this field.[23]

My barn burnt down, I can now see the moon.
— Mizuta Masahide

CONTEST BETWEEN TWO IDEAS

The notion of India is being contested on the social media, in newspapers and magazines, in school and college curricula, and in the political arena.

One may call the contest as between the "Positivists" and the "Left". Some prefer to use the term nationalists and internationalists but that is false, since the positivists also seek increased engagement with the rest of the world. Also the Left is not the historic internationalist left that was against imperialism; the new Left is aligned with the Big Tech global companies that want hegemonic power. The Left is opposed to the Positivists for giving more space to India's own cultural symbols for that makes the world a bit more complicated place.

One may be surprised that so much of passion is going into this fight over the past. But as George Orwell famously said: "Those who control the present, control the past, and those who control the past control the future." The Left still owns the official version of India's past and it doesn't want to give it up without serious fight.

The Positivists say that Indian culture is humanistic and universal; it has no dichotomy of believer and non-believer, and due to its tradition of inner sciences, it has the capacity to deal with the challenges and disruptions that AI will cause everywhere. They wish to integrate with the world system of education and science and want India to play a greater role in world affairs. The Left dismisses this saying that the Positivists are seeking to foist false history. It wants to be the gatekeeper to media narratives on India to ensure that only interpretations that it considers valid are passed on.

Not surprisingly, the Left is aligned with the British Raj view[24] that India needs the West to help govern itself. More than anything else, it hates the idea that India was a land devoted to knowledge (Bhārata) for that would mean it has the capacity to be truly independent, and have agency. The Westernized Indian has a deep sense of inferiority and is afraid to make products, intellectual or physical, to compete on the world stage, and is quite happy to play the understudy and work in the back-office. Privately, the Westerner laughs at the shallowness of these mimic men and women,[25] but finds it easy to do business with them.

NOTES

1. Kak (2020)
2. Kak (2018b)
3. Davis (2000)
4. Dharampal (1983)
5. Clingingsmith et al (2005)
6. Kak (2021b)
7. Adluri and Bagchee (2014)
8. Danino (2018)
9. Fárek et al. (2017); Raheja (1988)

10. Kak (1993)
11. Clingingsmith et al (2005)
12. Kak (1993)
13. Indian Census of 1881.
14. Robb (1997)
15. Bayly (1999)
16. Dosanj (2014)
17. Berg and Wendt (2014)
18. Trautmann (2005)
19. al-Andalusi (1991)
20. Dharampal (1983)
21. Kak (2018a)
22. Kak (2021a)
23. Kak (2015)
24. Kipling (1920): "[The British] did establish and maintain reasonable security and peace among simple folk in very many parts of the world, and that, too, without overmuch murder, robbery, oppression or torture." Behind this lay the idea that India should let the English with their superior civilization to govern them.
25. V.S. Naipaul coined this memorable term in his novel *The Mimic Men* (1967).

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Racism, Eurocentrism, and Indology*

INTRODUCTION

Imagine this: While traveling through a foreign land, you find an announcement of a public lecture about your country at the hotel. Being free that afternoon and feeling nostalgic for home, you and your spouse go to the lecture and discover that while the speaker knows the broad elements of the history of your country, his understanding is so shallow that it borders on nonsense.

What can you do? You can't just say, "Excuse me, but you have it all wrong." No, because you're in a foreign country, and your spouse will never forgive you for creating a commotion. Not wanting to be rude or be accused of grandstanding for attention, you hold your tongue and walk out at the first opportunity. Later, you speak privately with the speaker and find it is not just him, he was taught wrong stuff at his college; it is pervasive.

This is the big scandal of Indology:[1] Almost all you have in academic textbooks about ancient India is either superficial, banal, half-truths or plain wrong. The understanding of earliest India offered by the Indology community is based on flimsy philosophical and methodological foundations and a deep misunderstanding of the texts.

Here's what the great scholar Ananda Coomaraswamy in his book *Hinduism and Buddhism* (1943) said of the accounts of Hinduism by Western scholars and their Indian followers:

> [A]lthough the ancient and modern scriptures and practices of Hinduism have been examined by European scholars for more than a century, it would be hardly an exaggeration to say that a faithful account of Hinduism might well be given in the form of a categorical denial of most of the statements that have been made about it, alike by European scholars and by Indians trained in our modern skeptical and evolutionary modes of thought.

Worse, it is a racist[2] enterprise in which the stated objective is to teach Indians what their books mean. Its premise is that Indians are culturally backward, they never developed scientific or critical thinking, and they lack access to the "true" meaning of their texts. It is further implied that the original authors of the *ur*-texts, which over the millennia have expanded into voluminous tomes with what they say have internal contradictions, were outsiders like the Indologists themselves, and the current confusing state of the texts reflects cultural shortcomings of Indians as a consequence of the intermingling of the original Indo-Europeans with the lesser races of India!

Hold it, you say! Isn't it stupid to believe this? India is one of the cradles of world science[3] that includes logic, grammar, rhetoric, mathematics, medicine, astronomy,

* Medium & Academia.edu

aesthetics, moral and political discourse[4], not to mention stories and fables[5]. Modern science itself has much that is based on Indian contributions[6] and Indians are in the vanguard of contemporary science. The Indologists are generally ignorant about science so they respond by saying that these are contributions to Western enterprises and besides, they add, what they are pointing to are Indian cultural deficiencies (although they mean race but they are savvy enough to know that it is not politically correct to mention it).

You say that couldn't be true, for Indians are amongst the most successful entrepreneurs in the West and the wealthiest ethnic group[7] in the United States, where there is a level playing-field. They say, maybe "yes", but it's only because Indians are mimicking the Westerners. And then they change the subject and say that when it comes to the old texts, Indians carry so much of emotional baggage that only they (the Western Indologists) can interpret them correctly.

But how can people in the academy believe in such racist stuff? Why haven't these folks been drummed out of their jobs for stupidity, if nothing else?

FIRST HUBRIS, THEN SCANDAL

The answer is a complicated story. But first, the calling attention to this scandal is not a reaction of Indians to the painful memory of their colonized past. Scholars both in the West and India have for decades pointed to the hollowness of the assumptions of Indology and the absurdity of their conclusions.

Neither does the scandal have anything to do with the national origin of the professors or whether they belong to one tradition or the other. Many Westerners have done wonderful work on India and paralleling that many Indian "scholars" have done shoddy work. To get true insight in any field, one needs to approach it with humility and pure heart, and suspend the lens of one's own tradition, whatever that might be. In the world of wisdom and insight, class, nationality or race do not matter: we are all equal.

In private conversations with academics who work on India, there is acknowledgement that there is a cabal that consists of racists, European supremacists, leftists and others who might be sincere but so marinated in an obviously wrong paradigm that they don't even know they are wrong. And then, of course, there are the thick-headed ones who just don't get it; one of them once wrote me an email saying that only "philologists have the authority to interpret ancient India."

One of the most astonishingly stupid statements I ever read is the one by Frits Staal who in the preface of his book *Discovering the Vedas: Origins, Mantras, Rituals, Insights* says: "The Ṛgveda is composed in a language so distant even from classical Sanskrit, that only Europeans who were familiar with their own classical languages could have begun to crack its forms and codes." I knew Frtis Staal a bit and before he left to live in Thailand upon retirement he gifted me his book on stamps of Jammu and Kashmir; in his earlier career he had done some nice work on the Agnicayana ritual and Indian grammatical tradition. The only explanation for the quoted statement is that in the isolation of his retirement he reverted to atavistic European views.

Unbiased editors, themselves academics, are aware that many Indology professors are so fanatical and politicized so as to have lost contact with the truth. This explains how I came to be invited to write several dozen encyclopedia articles on ancient India: if you look, for example, at Stanley Wolpert's authoritative *Encyclopedia of India* (2005), you will see I have the second-most number of contributions, eighteen, next only to Wolpert's own nineteen.

To be fair, the Indologists made useful contributions in lexicography, manuscript preservation and collation in the 19th century. If one may use Bhartṛhari's categories, it was good work at the vaikharī and the madhyamā levels but quite wrong at the paśyantī.

The Indologists missed the larger meaning that provides coherence to the Indian texts[8]; this is why their mistakes have continued generation after generation. Sri Aurobindo was right to point out that the European interpretations of the Vedas are essentially worthless.

To make sure that there is no misunderstanding, what I mean by the enterprise of the Indologists are narratives on ancient India and to the extent they affect understanding of the later periods. I acknowledge the useful contributions scholars from the West have made to the study of the classical period and more recent periods.

ACADEMIC INDOLOGY

Historically, the universities in Germany began the academic study of India and this serves as basis for western interpretations of ancient Indian history and traditions. In *The Nay Science: A History of German Indology*, Vishwa Adluri and Joydeep Bagchee chart the history of the discipline to show its questionable philosophical assumptions, anti-Semitic and anti-Brahmanic attitudes, and racial prejudice.

English administrators dismantled India's education system and Indians became progressively alienated from their tradition as they were compelled to do higher education in English and sciences formed a very small part of its curriculum. The main objective of the higher education was to convert the people of India to Christianity as, for example, in the case of Boden professorship of Sanskrit at Oxford University. Monier Williams (1819–1899) who occupied this professorship for many years said in his book *Modern India and Indians*: "When the walls of the mighty fortress of Brahmanism are encircled, undermined & finally stormed by the soldiers of the cross, the victory of Christianity must be signal and complete."

In an interview[9], Adluri calls the racism of Indology insidious. "The Indologists had for so long told themselves that Indians lacked access to the "true" meaning of their texts that they no longer considered it a prejudice but a methodological principle and a necessary one at that." The Indologists declared that the texts were not to be read as Indians understand them for they lack scientific and critical thinking; they [Indologists] are the final judge of what India's culture and civilization was and is and only they can change India by intervening in its history by teaching Indians to understand their past that will give them the agency to make change.

Hermann Oldenberg, a 19th century leader of academic Indology, said that Indians are under the tyranny of "the misshapen, wild, cruel, [and] lascivious Hindu Gods, at their head Śiva and Viṣṇu." The Indologists saw themselves as revolutionaries who want to save the

Hindus quite in the same spirit as the Christian missionaries and the Tablighi Jamaat want to save Hindus.

Indologists saw Indian art as grotesque. John Ruskin, the English art historian of the Victorian era decreed that Indian architecture was systemless for it sprang from an irrational religion.[10] The attempt to fit Indian art to Western rationality sprang from the same impulse that led to iconoclasm in Christian Europe. But the 19th century belonged to the Age of Reason so they didn't want to physically destroy the art, they wished to control thought about it so that the only natural place for it would be the museum.

Images mediate abstract thought as is clear from the wealth of stories and cosmologies connected with the images of, say, Viṣṇu or Śiva, Durgā or the Buddha in India, or Athena, Apollo, and Dionysius in ancient Europe. Behind each image lies an entire epistemology, a knowledge system regarding lived reality. Idol-breaking is a projection of power over thought.

Boaventura de Sousa Santos speaks of *epistemicide*[11], that is, the extermination of knowledge and ways of knowing, as a key component of the drive in Europe and later in the Arab/Turkic worlds to power and domination. Its operation varied from burning books to extermination of people. Catherine Nixey[12] in her book *The Darkening Age* describes how most of the artwork and literature of European antiquity was destroyed by zealots. Faces, arms and genitalia of statues were mutilated, if not entirely broken. According to one estimate only about 10% of European literature survived. Similar destruction occurred in Arabia, Iran, Central Asia, and India.

Enrique Dussel's argument[13] is that centuries of "I conquer, therefor I am" (*ego conquiro*) was accompanied by the genocide/epistemicide of the "I exterminate, therefore I am" (*ego extermino*). It is from there that Descartes' slogan "I think; therefore, I am" (ego cogito) emerged. It was not a call to free thought, for here "I" represented the European, and everything outside of Europe was deemed inferior. Ramón Grosfoguel argues that the Western university has continued this process of epistemicide in the social sciences.

The drive by the Indologists to define India on their terms is entirely consistent with the larger European project of epistemicide.

The academic scholar is also fascinated by the Indian material for it doesn't quite fit the colonists mission. For example, Monier Williams, whom we encountered before, says:[14] "Indeed . . . the Hindus were Spinozaites more than two thousand years before the existence of Spinoza, and Darwinians centuries before Darwin, and evolutionists many centuries before the doctrine of evolution had been accepted by the scientists of our time, and before any word like 'evolution' existed in any language of the world."

ACADEMIC CONTROL

Christopher Minkowski, at his Inaugural Lecture for Boden Professorship at Oxford University is very transparent about the need to control Sanskrit studies. Lamenting that the Indian claim to Sanskrit's authority has not withered in spite of continual assault by the Indologists, he claims[15] that "if they accepted that claim, it would put them into a rivalry with

the language's traditionally trained, hereditary "native" experts."

Minkowski adds: "Modern scholars, then, sought a method for containing Sanskrit's potential to activate its cultural politics, by subjecting the study of Sanskrit to scholarly protocols which were antithetical to the language's genius and charisma. They opted for a decidedly unromantic array of curatorial and antiquarian forms of scholarship: philologizing, cataloguing, typologizing, organizing into chronologies, and so on; eminently useful practices, no doubt, but none of them glamorous."

In other words, the protocols are to deny Indian scholars of Sanskrit [an euphemism for India's own self-understanding of its culture] a place at the academic table. The origins of such academic control go back to James Mill, author of the highly influential *History of British India* (1817), who wrote this about the entire populations of China and India:[16]

> Both nations are to nearly an equal degree tainted with the vices of insincerity; dissembling, treacherous, mendacious, to an excess which surpasses even the usual measure of uncultivated society. Both are disposed to excessive exaggeration with regard to every thing relating to themselves. Both are cowardly and unfeeling. Both are in the highest degree conceited of themselves, and full of affected contempt for others. Both are, in the physical sense, disgustingly unclean in their persons and houses.

Mill condemned Indian culture as "barren, perverse and objectionable." And he wrote of Indians: "under the glosing exterior of the Hindu, lies a general disposition to deceit and perfidy. [And] the same insincerity, mendacity, and perfidy; the same indifference to the feelings of others; the same prostitution and venality are conspicuous in both [Hindus and Muslims]."

These ideas were to shape British policy in India directly as a high official of the East India Company, and indirectly through Thomas Babington Macaulay who devised a system of English education for the Indian elite.

Okay, Mill was a racist twit, but why should we care? *He has been dead a long, long time*. Mill's ideas matter for they remain powerful. Macaulay called Mill's book "the greatest historical work which has appeared since that of Gibbon." It was to become the text-book for the candidates for the Indian Civil Service and English educated Indians for several generations. Worst of all, its larger premise was adopted by the left in India and by academic control this view underlies school and college curricula in India, and *Indians continue to be exposed to the propaganda underlying this work.*

In his book, Mill set out to attack the history, character, religion, literature, arts, and laws of India. He justified the colonization of India and the rapine of its resources as a by-product of bringing civilization to the country.

Mill's ideas provided the rationale for colonial rule that was described by Kipling as "The White Man's Burden." It has been estimated that British colonial rule, with its destruction of Indian industry and education, cost India $45 trillion in today's dollars. But worse, India's Anglophone elites swallowed the colonial nostrums about Britain's civilizing role and

embraced what the American historian Thomas Trautmann has called "British Indophobia"[17] [another name for Hinduphobia].

China dealt with attitudes such as that of James Mill with the slogan to end "The century of humiliation" and in the past half-century has striven to match the glory of its imperial past. China was able to rediscover its spirit of excellence because, unlike India, its elites are not alienated from its own culture and history.

Seventy years ago, India's education bureaucrats decided to keep out India's own sciences and other scholarly traditions from school and college curricula on the false pretense that they are part of religion.

Kapila Vatsyayan, modern India's eminent scholar of art and a good friend, who passed away just a few months ago, once told me that colleges Britain founded in India served their own needs for clerks and soldiers to help in the extraction of Indian wealth and to protect the Raj, with some effort thrown in to understand India's past so that they could control it better.

The fields that they left alone — art, music, dance and yoga — are the only ones that have any vitality left. Indeed, people from all over the world travel to India to learn these fields. Behind these fields lies Indian philosophy, that remains sidelined in Indian academia as something provincial, fit only for those who are stuck in the past.

DELUSION AND ĀTMAVIDYĀ

One reason that the Indologists are befuddled is because of incorrect assumptions about the nature of Indian society. In my view, India was not fundamentally different from the rest of the world, and jātis are very much like communities elsewhere in the world. The caste system as we see it was created by the British for the jātis "were not aware of the specific varṇa class they belonged to but were squeezed into the varṇa system by the British administrators."

Likewise, the Brāhmīns were not unlike priestly communities world over and their class was not closed. We know from modern times that communities can just declare themselves to be one varṇa or another and the same process doubtlessly occurred in the past.

Even if one were to excuse their self-confessed bias, why did the Indologists turn out to be so totally wrong in their understanding of the texts? Many of them were competent and patient scholars who were trying their best to make sense of what they had in front of them.

The answer is that the Indian texts have traps for the uninitiated. If the process of understanding involves many steps in a ladder, there is much in the texts that will let you believe you have reached the top at whatever step, if that is where you want to be. Thus, there is room in the texts both for those who believe that the ritual is only outer, and others who believe it is symbolic.

When it comes to moral precepts, the Dharmaśāstras present material that might be contradictory in details because different subsets of these precepts were embraced by different communities. It was a system perfected for diversity.

Most significantly, if ātmavidyā, the central science of the Vedas, cannot be described in the usual categories of language as Muṇḍaka Upaniṣad instructs us, then the description

through different lenses (not just the six main darśanas but many more that can be imagined) will have elements that are in contradiction. It is indeed a case of the six blind men feeling an elephant and coming up with different descriptions. The contradictions are both at the philosophical and the ritual levels and part of the instruction is to reach these contradictions (as crises of faith) to prepare oneself for intuitive insight that takes one to a deeper understanding.

Indian texts require navigating through their own protocols. This is where the guru or the teacher comes in, and oral instruction is extolled. The Indologist reads this somewhere and gets lost and thinks this means that there is no written stuff anywhere! They don't get that the context is everything and the declarations within the tradition are not to be taken literally.

I have been surprised how many Western acolytes interpret stories of a spiritual master's presence at two places at the same time as the literal truth. Growing up in the company of sadhus and other spiritual people, one learnt to separate the word from the image.

The Indologists are using concepts from their society to look at India, concepts that are too limiting. They don't get India for they misunderstand the foundations of its culture. This will explain the strange books and articles being churned out on how there was no writing in India no matter if Pāṇini says he knew writing, how the Brāhmīns cunningly converted most of Asia to their ideology, and how through yoga, which in their view has nothing to do with Hinduism even though it is the heart of the Bhagavad Gītā and one of the six darśanas, they are spreading their ideas around the world.

One might ask how did the Indologists prosper for this long? First there were the imperatives of empire and conversion.[18] In more recent decades, there has been a convergence in the program of the Indian political left (to save India from the clutches of tradition) and that of the Indologists. Due to centralization of the academic system in India and its control by the left for decades, the alliance had patronage.

If Indian ideas are spreading, it is only because the Indian tradition speaks to the problem of consciousness, which is also the frontier of modern science; it is a problem that the Western traditions have largely ignored.

The Indian system does not depend on the machinations and cunning of any specific class of people. It offers a universal message open to all in which each person is equal for the same puruṣa (consciousness) resides within each, and it is more than high talk for it offers practices related to self-discovery. That is something that the professional Indologist does not appear to understand.

NOTES

1. Adluri and Bagchee (2014); see also Kak (2015) for a broader look at Western representations of India.
2. The distinguished British anthropologist Edmund Leach (1990) calls it a "racist framework"; see also Adluri and Bagchee (2018).
3. Kak (2021) for an overview of Indian science.
4. Heesterman (1991).

5. See, for example, Winternitz (1907).
6. Kak (2018a)
7. American Community Survey (2018)
8. Coomaraswamy (1943); also see Kak (2018b) and the references therein.
9. Adluri (2017)
10. Mitter (1992)
11. Santos (2016)
12. Nixey (2018)
13. Dussel (2014)
14. Monier-Williams (1891). An amusing sidelight: Monier Williams changed his name to Monier Monier-Williams in 1887, when he was 68 years old; he was Boden professor 1860-1899.
15. Minkowski (2006)
16. Mill (1817)
17. Trautmann (1997)
18. Max Muller in his letter to his wife: "I hope I shall finish that work (translation of Ṛgveda), and I feel convinced, though I shall not live to see it, that this edition of mine and the translation of the 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 that root is, I feel sure, is the only way of uprooting all that has sprung up from it during the last 3000 years". "…The missionaries have done far more than they themselves seem to be aware of, nay, much of the work which is theirs they would probably disclaim. The Christianity of our nineteenth century will hardly be the Christianity of India. But the ancient religion of India is doomed- and if Christianity does not step in, whose fault it be?"
    (The Life and Letters of Max Müller, vol.1, pages 328 and 357-358)

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20
A Reading of the Brāhmī Letters on an Anthropomorphic Figure*

harappa.com

INTRODUCTION

Just over a decade ago, Sanjay Kumar Munjal and Arvin Munjal published in Prāgdhārā the image of a copper anthropomorphic figure of Varāha (boar) that was found in the foundation of a house in a village called Kheri Gujar in Sonepat District in Haryana. The house itself rests on an ancient mound that has been variously dated to Late Harappan. The object is about 2 kg., and has dimensions of 30×28.5 cm.

The object is a significant find since it has the image of the Harappan unicorn inscribed on it as well as Brāhmī letters and, therefore, it represents a bridge between these two phases of Indian culture. The idea of the unicorn (ekaśṛṅga, एकशृङ्ग) appears in the Purāṇas, and in the Śānti-Parva (chapter 343) of the Mahābhārata; it is the one-tusked boar (Varāha) who saves the earth as Viṣṇu's incarnation.

* OSU (2018)

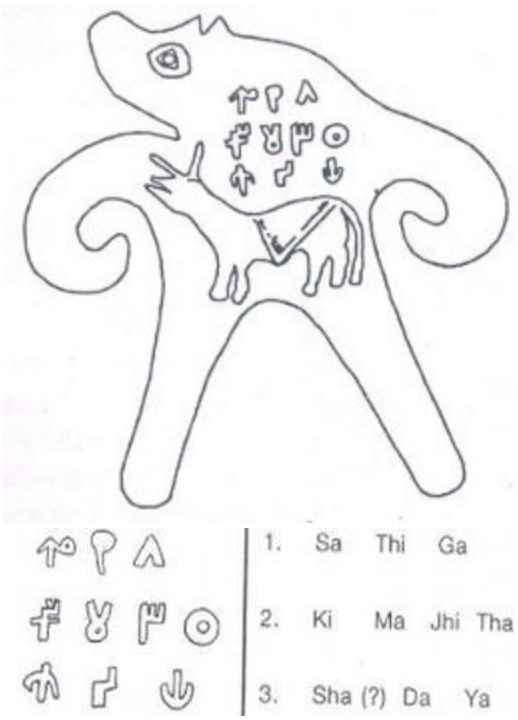


Figure 1. The copper object and the text together with the reading in [1]

The Brāhmī letters on the copper object were read by the Munjals [1] rather hurriedly (as we show in this paper) without any further analysis. Here we wish to provide further analysis of the text and show that we must change the earlier reading for 3 letters. This correction opens up the possibility of a deeper understanding of the object as the text appears to be formulaic in a standard manner.

THE TEXT ON THE OBJECT

The reading of the Munjals is reproduced below:

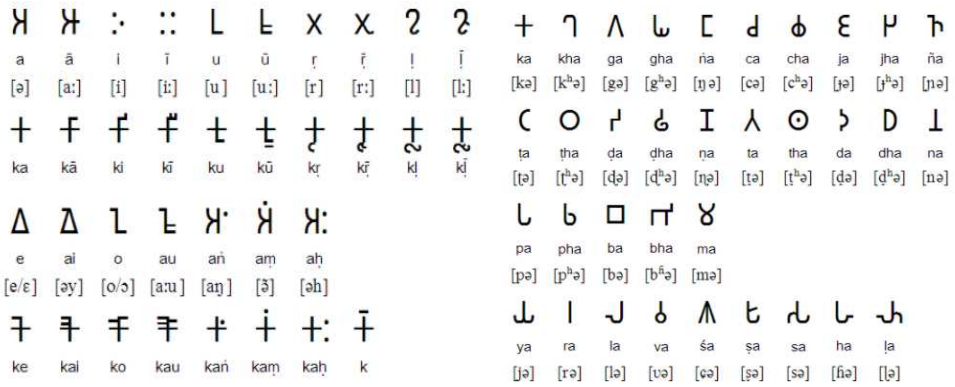
sa thi ga
ki ma jhi tha
sha (?) da ya

The letters are standard Brāhmī syllabic letters with 3 exceptions. For background information on this script and its possible connections with the so-called Indus (also called Sarasvatī) script, see [2]. In my view, the strongest argument in favor of Indus-Brāhmī continuity is that the 10 most likely letters in the two scripts are virtually unchanged while maintaining their rank order [3], the numerals for 5 and 10 look similar, and the text endings have a form that is consistent with Sanskrit grammar [4],[5].

Figure 2. Close ups of the unicorn figure and the Brāhmī letters.

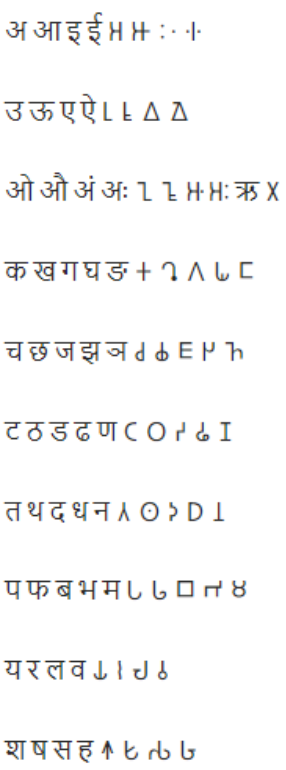
Brāhmī vowels and diacritics as well as the consonants are described below and as is clear that for many letters the Devanāgarī forms are small modifications or rotations of the Brāhmī ones. For many letters the Devanagari letters append a vertical line, and of course the horizontal line at the top.

Table 1. Brāhmī vowels *(left)* and consonants *(right)*



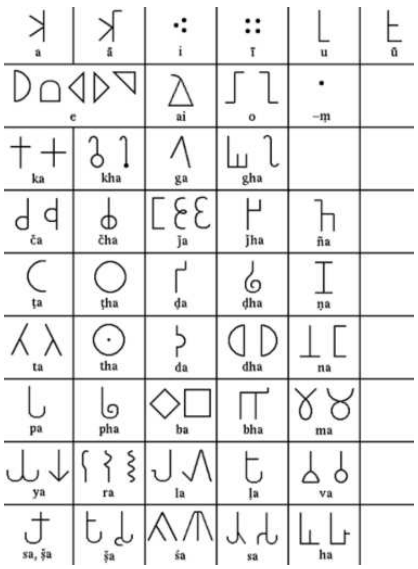
For easier comparison, we provide the Devanāgarī and the Brāhmī letters side by side in Table 2.

Table 2. Devanāgarī and Brāhmī varṇamālā



Some variants of the Brāhmī letters were also in circulation as shown in Table 3.

Table 3. Variants of Brāhmī varṇamālā



BRĀHMĪ LETTERS WITH VARIANTS

As we can see from Figure 2 and Table 1, most of the letters on the figure are clear, but there is a little ambiguity about the second letter in the first row and the first letter in the third row.

The Munjals read the very first letter as "sa" but that is incorrect, even though the letter is quite clear. The first letter is the upward pointing arrow, together with a dot on the right, which represents "śam" or शं. This is significant since शं is the beginning of several invocatory Vedic formulas.

The second letter in the first row is wide at the top and has a line to the bottom. The only letter that could conceivably satisfy this property is "ña" and so I propose this reading instead of "thi". The smearing of the text at the top could be later damage or a scribal error. The third letter in the first row is an unambiguous "ga".

In the second row, the third letter may not be "jhi" as its second hook to the right is bigger than what is appropriate for the diacritic for "i". Could it be an erroneously inscribed "gha"? We can't tell and so, tentatively for this article, I shall stick with "jhi". But this reading needs further examination.

The first letter in the third row is nowhere "sha" and indeed it is closest to "ta".

We now read the letters as:

śam ña ga
kī ma jhi tha
ta ḍa ya

शं ञ ग
की म झि थ
त ड य

The beginning appears to be similar to the invocation in the Taittirīya Upaniṣad.

om śam no mitraḥ śam varuṇaḥ
śam no bhavatvaryamā
śam no indro bṛhaspatiḥ
śam no viṣṇu rurukramaḥ

ॐ शं नो मित्रः शं वरुणः ।
शं नो भवत्वर्यमा ।

शं नो इन्द्रो बृहस्पतिः ।
शं नो विष्णुरुरुक्रमः ।

FURTHER INTERPRETATION

The "ga" of the first line could stand for Gaṇapati, a post-Vedic deity. If it is so, this is consistent with the identification of the Harappan period to be identical to early Vedic.

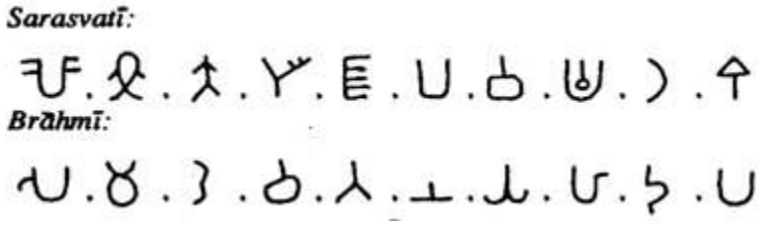
The second line could invoke different deities.

The taḍaya of the third line may suggest punishment to inimical agents.

CONCLUSIONS

The occurrence of शं as the first letter is significant for it connects the text to the post-Vedic period. It is also significant that the letters are written from left to right, which is the standard way for Sanskrit. The reading favors the view that Brāhmī is derived from the Indus script, which is something I have argued in several papers. The figure below (from [5], where I use the name Sarasvati for Indus) shows how the 10 most frequently occurring signs of Indus and Brāhmī have surprising similarity. The frequencies of the Brāhmī letters are from our knowledge of Sanskrit letter frequencies, and those of Indus are from the records on seals and tablets that have come to us. Since the Indus letters cannot be fully representative of the corresponding language, the degree of overlap is quite impressive.

Table 4. Ten most frequent Indus (Sarasvatī) and Brāhmī signs



Some will be surprised at this evidence of Indus-Brāhmī continuity for it goes against the 19th century theory that Brāhmī was devised during the time of King Aśoka (ruled 268–232 BCE) based on influences from the West that came in with the Achaemenid empire. But this view was challenged by many scholars right from the time that the Indus texts were discovered. The discovery of Brāhmī writing in Sri Lanka that has been dated to as early as 450 BCE [6] also disproves the theory of the foreign origin of Brāhmī.

The uncritical acceptance of the old theory was driven by colonialism and Eurocentrism that insisted on tracing all innovations in India to the West. Some have gone so far as to fabricate evidence [7] in support of this theory; others simply ignore any evidence that goes against the entrenched model.

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PART 4

INNER AND OUTER COSMOSES

21
Time, Space and Structure in Ancient India*

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.

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.

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* Conference on Sindhu-Sarasvati Valley Civilization: A Reappraisal. Loyola Marymount University, Los Angeles, 2009

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.

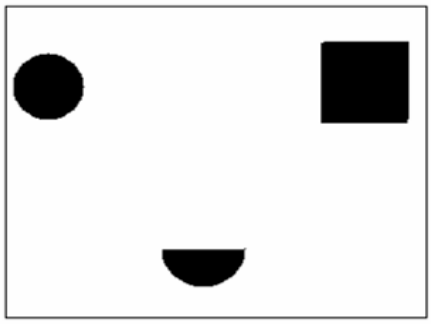

Figure 1. The three altars of the Vedic house: circular (earth, body), half-moon (atmosphere, prāna), square (sky, consciousness)

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. The symbolic meaning of this is that the ceremonies of the great altar subsume all ritual (Kak, 2008).

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 that is to be found in the Vedic hymns, the Epics, the Yoga Vāsiṣṭha, and the Purāṇic texts.

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).

191 Book 10	114 Book 9
104 Book 7	92 Book 8
87 Book 5	75 Book 6
62 Book 3	58 Book 4
43 Book 2	191 Book 1

Figure 2. The Ṛgveda as an altar

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.

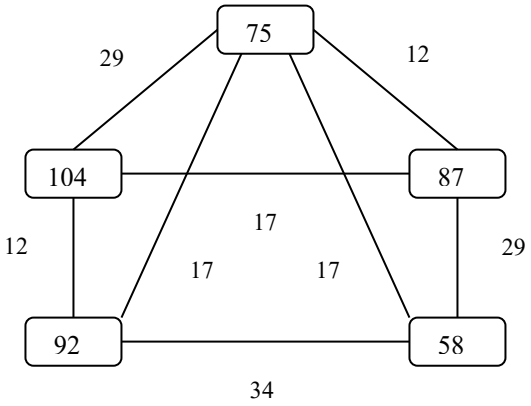

Figure 3. The Ṛgveda books 4-8 as a graph

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 3×339, 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 $108\times\pi\approx339$. 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.

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 now 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 6×6) 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).

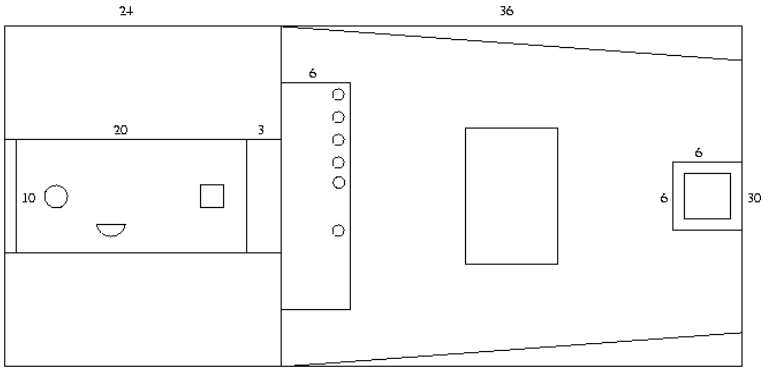

Figure 4: The temple plan: The perimeter is 180 units and the axis is 54 units to the high altar

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.

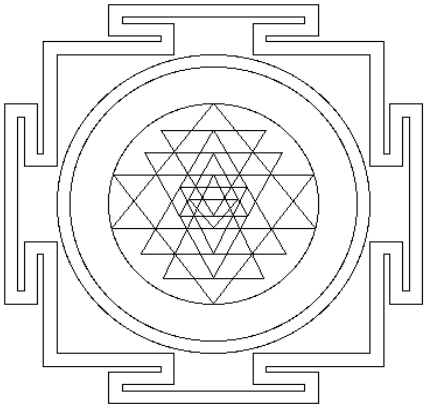

Figure 5. The Śri Cakra

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.

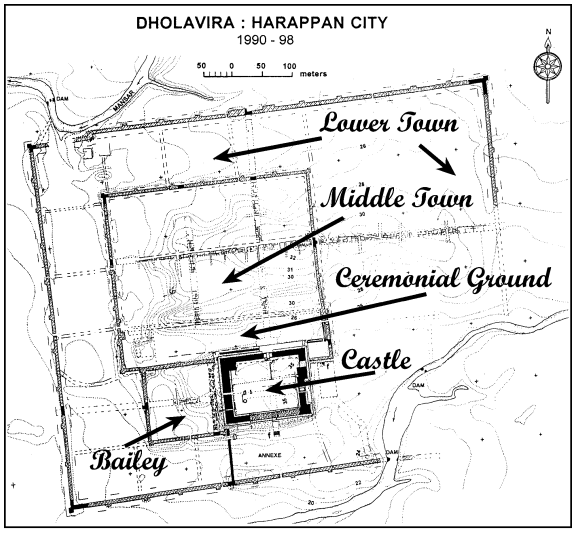

Figure 6. Map of Dholavira (Bisht, 1997)

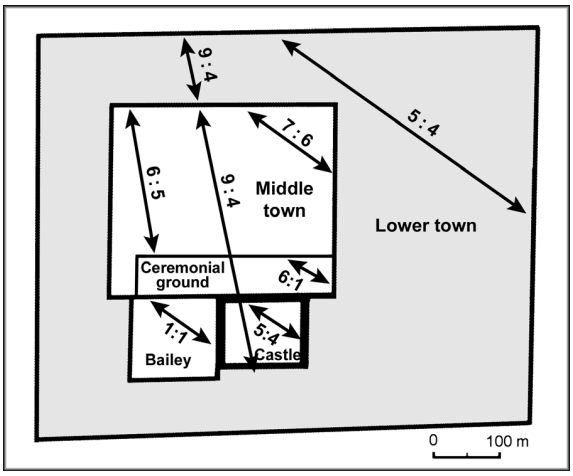

Figure 7. Proportions from Dholavira (Danino)

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.

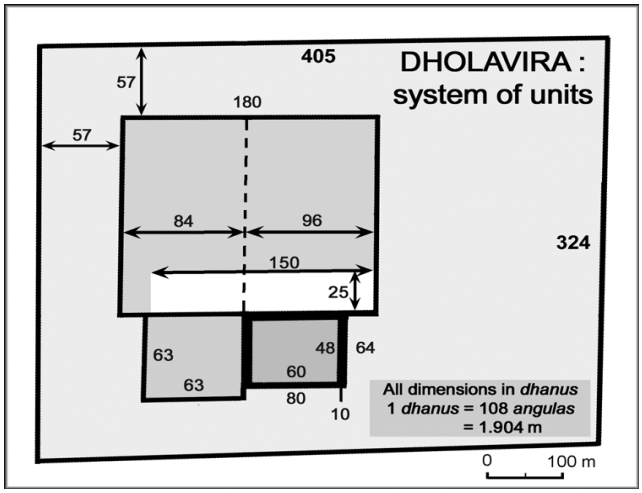

Figure 8. The dimensions of Dholavira in terms of dhanus (Danino)

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. The Bṛhat Saṃhitā 53.31 calls a building with a verandah running all around as “sarvatobhadra”.

Figure 10. The Deogarh temple

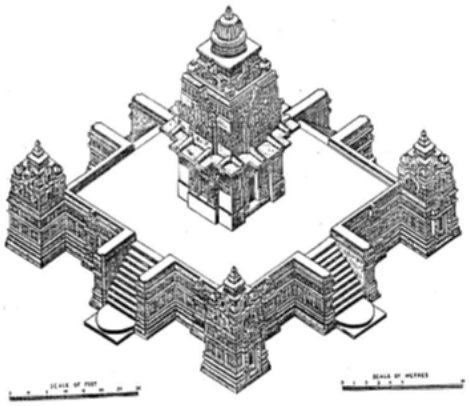

Figure 11. Reconstruction of Deogarh temple by Vats

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 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.

Acknowledgement. I would like to thank M. Danino and the late R. Balasubramaniam for comments on earlier versions of this paper.

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22
The Garbha Upaniṣad: How Life Begins*

Mother Goddess and Child 600 CE/ Simon Norton Museum

॥ गर्भोपनिषत् ॥
यद्गर्भोपनिषद्वेद्यं गर्भस्य स्वात्मबोधकम् ।
शरीरापह्नवात्सिद्धं स्वमात्रं कलये हरिम् ॥

WHENCE ARE LIVING BEINGS BORN?

What is life and how does it begin? How does awareness dawn in the developing fetus? These are questions that Sage Pippalāda asks in this astonishing text of the Garbha Upaniṣad[1]. Pippalāda is also credited with the answers in the Praśna Upaniṣad, which is one of the primary UpaniṣadS and one of the oldest. The six questions in the Praśna Upaniṣad are:

1. Whence are living beings born?

* LSU (2019)

2. How many devas (powers) uphold and illumine a living being?

3. Whence does life come into the body? How does it abide? How does it go out of the body? How does life interface with the external world? How is it connected with the Self?

4. What powers are quiescent when one sleeps, and what powers are awake? Who sees the dreams? Who experiences happiness? In whom are all these established?

5. If one were to meditate on the symbol "Om" until death, what would one obtain by doing so?

6. Who is the person with sixteen parts? (This is a question about the different modes of the Self.)

These are the deepest questions of life and remain as urgent now as they were three or four thousand years ago. My objective is not to revisit these questions but only to focus on Pippalāda's answers provided in the Garbha Upaniṣad, which is a companion text with deeper responses to some of these questions.

There is no unanimity about the date of the Garbha Upaniṣad. Since it is ascribed to Pippalāda, we need to determine this sage's place in the Vedic tradition, although it is believed that the text may not be as old as the sage. Pippalāda is also the author of the Atharvaveda śākhā named after him (Paippalāda śākhā). If the Ṛgveda is to be taken to be no later than 2000 BCE as suggested by hydrological evidence related to the drying up of the Sarasvatī River that the Ṛgveda celebrates as flowing from the mountains to the sea[2], then as a principal arranger of the Atharvaveda, Pippalāda should be assigned to at least the middle of the second millennium BCE. But there are some Western scholars who believe these dates are a thousand years too long and the Garbha Upaniṣad should be assigned to 600 BCE or so.

According to the Purāṇas, Pippalāda was the disciple of the Ṛṣi Vedasparśa, and he instructed Yudhiṣṭhira in the significance of the Aṅgāravrata, which is based on a dialogue between Śukra and Virocana.

The physiological knowledge in the Garbha Upaniṣad is consistent with that found in the oldest Upaniṣads. Like the other texts, it speaks of recursion, but it doesn't list as many channels (veins and nerves) as some other texts do. This indicates that this Upaniṣad may be older than has been assumed.

Pippalāda's six questions in the Praśna Upaniṣad are reminiscent of the six darśanas that touch upon six different aspects of reality: logic and structure of speech (nyāya), structure of matter (vaiśesika); creation at the cosmic and personal levels (sāṅkhya), synthesis of matter and mind (yoga); analysis of lived life (mīmāṃsā), and understanding of overarching reality (vedānta). This is not an argument for the lateness of the Praśna Upaniṣad, but rather for the remote antiquity of six bases to reality, which mirror the six directions[3].

For a proper understanding of the Garbha Upaniṣad it is essential to understand the subtle ideas of recursion[4], physiology and consciousness, channels in the body, and causal chain and birth.

Like other sages of the Upaniṣads, Pippalāda is systematic and rational. The physical basis of life, and the sequence following the development of the embryo, is clearly defined.

He describes the basis of life mystically in categories that go, in sequence, from 2 to 7. In the body emerge 8 natures and in it arise 16 modifications that are similar to the tattvas of Sāṅkhya and the modes indicated in Praśna Upaniṣad 6.4.

The embryo is taken to have become jīva (conscious self) in the seventh month, and in the eighth month, it becomes complete in every sense. This gives the time the fetus becomes a person, with attendant legal rights. It is not explained how the jīva comes to be attached to the body.

Although other passages indicate that the jīva resides in the heart's recess, it also suffuses the entire body; furthermore, its identity with the Puruṣa means that, mysteriously, it is one with the entire universe. The distinction also implies the existence of the subtle body (liṅgam). In the Sarvasāra Upaniṣad 7, the subtle body is defined as created out of the mind and other subtle elements that reside in the knot of the heart. The consciousness within this subtle body is called the "knower of the field" (kṣetrajña).

The body is an instrument of the heart, but for it to be able to do what it can, the kṣetrajña must be free: this is mokṣa or mukti.

RECURSION

Recursion, the mirroring of the cosmos at several levels, including at the level of the body, is one of the central ideas of the Upaniṣads. It is clearly stated, for example, in the Chāndogya Up. 8.1.1 and 3, where we are told that within the heart is this small place with the heaven, earth, sun, moon, and stars where the lights of the universe shine.

> अथ यदिदमस्मिन्ब्रह्मपुरे दहरं पुण्डरीकं वेश्म दहरोऽस्मिन्नन्तराकाशस्तस्मिन्यदन्तस्तदन्वेष्टव्यं तद्वाव विजिज्ञासितव्यमिति ॥ ८. १. १ ॥
> यावान्वा अयमाकाशस्तावानेषोऽन्तर्हृदय आकाश उभे अस्मिन्द्यावापृथिवी अन्तरेव समाहिते उभावग्निश्च वायुश्च सूर्याचन्द्रमसावुभौविद्युन्नक्षत्राणि यच्चास्येहास्ति यच्च नास्ति सर्वं तदस्मिन्समाहितमिति ॥ छान्दोग्योपनिषद् ॥ ८. १. ३ ॥

There is in this city of Brahman (the body) the mansion in the shape of a lotus and in it the small inner ākāśa (sky). What lies there that should be sought, which one should seek to understand?'

As large indeed as is this ākāśa, so large is that ākāśa in the heart. Within it are contained both heaven and earth, both fire and air, both sun and moon, lightning and stars; whatever there is of him (*asya*) in this world and whatever is not, all that is contained within it. (Chāndogya Up. 8.1.1 and 8.1.3)

This recursion is also expressed across time, and it leads to a variety of paradoxes that, the Vedas tell us, cannot be explained away by language. It is described most clearly in the last (fifth) section of the Garbha Upaniṣad in which the body itself is seen as the ground of the sacrifice.

Speaking of recursion, one must also mention hiraṇyagarbha, the golden womb out of which, the Veda tells us, the universe emerged. In an abstract sense, creation at the cosmic

level is to be understood in a sense similar to that at the individual level.

PHYSIOLOGY AND CONSCIOUSNESS

Now we consider the most interesting assertion that the body consists of 107 marmas (weak spots), 180 sutures or junction points, 109 snāyu (sinews), 700 veins, 500 majjā (muscle), 360 bones, and forty-five million hairs.

The numbers 180 and 360 are obviously astronomical and related to the number of days in the civil year. Their occurrence is the assertion of the mirroring of the cosmos in the body.

The numbers 107 and 109 are also, but less obviously, astronomically related. I have shown elsewhere (see References 1 and 2) that the Vedic Ṛṣis characterized the universe by the measure of 108, for it represents the distance to the sun and the moon from the earth, in multiples of their respective diameters. If the body mirrors the universe, it will have 108 parts, with 107 vulnerable joints (marmas), and 109 lashes to hold them together (snāyu).

Other Upaniṣads (e.g. Aitareya 3.3) speak of four kinds of life: born alive, born from egg, born from moisture (insects), and born from germ (plants).

> बीजानीतराणि चेतराणि चाण्डजानि च जारुजानि च स्वेदजानि चोद्भिज्जानि चाश्वा गावः पुरुषा हस्तिनो यत्किञ्चेदं प्राणि जङ्गमं चपतत्रि च यच्च स्थावरं सर्वं तत्प्रज्ञानेत्रं प्रज्ञाने प्रतिष्ठितं प्रज्ञानेत्रो लोकः प्रज्ञा प्रतिष्ठा प्रज्ञानं ब्रह्म ॥ ऐतरेय उपिनषत् ३.३ ॥

[These all] are born of eggs, of wombs, of moisture, and of sprouts, namely horses, cattle, men, elephants, and all creatures that there are that move or fly and those that do not move. All these are guided by consciousness and supported by consciousness; the basis is consciousness. Consciousness is Brahman. (Aitareya Up. 3.3)

Consciousness is taken to exist not only in the human, but in all life.

CHANNELS IN THE BODY

The count of 700 channels does not go to the usual details that are to be found in other Upaniṣads. Thus Pippalāda instructs Āślavāyana in Praśna Upaniṣad 3.6:

> अत्रैतदेकशतं नाडीनं तासां शतं शतमेकैकस्या द्वासप्ततिर्द्वासप्ततिः प्रतिशाखानाडीसहस्राणि भवन्त्यासु व्यानश्चरति ॥ प्रश्नोपनिषत्/तृतीयः प्रश्नः ३.६ ॥
> Here there are one hundred and one channels;
> each of these has one hundred more;
> each further has seventy-two thousand branching channels;
> through which the vyāna (breath) courses. (Praśna Up. 3.6)

This means that the total number of channels (veins, nerves) equals: 101 + 101×100 + 101×100×72,000 = 727,210,201. Of these, the most significant channel is the suṣumnā.

Bṛhadāraṇyaka Upaniṣad 2.1.19 speaks of how the Self returns to the body along the 72,000 hitā channels, which branch off from the heart to all parts of the body. This together with a further description of these nerves of four colors is described well in the Kauṣītaki Brāhmaṇa Upaniṣad:

> तं होवाचाजातशत्रुर्यत्रैष एतद्बालाके पुरुषोऽशयिष्ट यत्रैतदभूद्यत एतदागाद्धिता नाम हृदयस्य नाड्यो हृदयात्पुरीततमभिप्रतन्वन्ति तद्यथासहस्रधा केशो विपाटितस्तावदण्व्यः पिङ्गलस्याणिम्ना तिष्ठन्ति । शुक्लस्य कृष्णस्य पीतस्य लोहितस्येति तासु तदा भवति । यदा सुप्तःस्वप्नं न कञ्चन पश्यत्यस्मिन्प्राण एवैकधा भवति तथैनं वाक्सर्वैर्नामभिः सहाप्येति चक्षुः सर्वै रूपैः सहाप्येति श्रोत्रं सर्वैः शब्दैः सहाप्येतिमनः सर्वैर्ध्यातैः सहाप्येति स यदा प्रतिबुध्यते यथाग्नेर्ज्वलतो सर्वा दिशो विस्फुलिङ्गा विप्रतिष्ठेरन्नेवमेवैतस्मादात्मनः प्राणा यथायतनंविप्रतिष्ठन्ते प्राणेभ्यो देवा देवेभ्यो लोकास्तद्यथा क्षुरः क्षुरध्यानेऽवहितः स्याद्विश्वंभरो वा विश्वंभरकुलाय एवमेवैष प्राज्ञ आत्मेदंशरीरमात्मानमनुप्रविष्ट आ लोमभ्य आ नखेभ्यः ॥ १९ ॥
>
> तमेतमात्मानमेतमात्मनोऽन्ववस्यति यथा श्रेष्ठिनं स्वास्तद्यथा श्रेष्ठैः स्वैर्भुङ्क्ते यथा वा श्रेष्ठिनं स्वा भुञ्जन्त्येवमेवैषप्राज्ञात्मैतैरात्मभिर्भुङ्क्ते । एवं वै तमात्मानमेत आत्मानो भुञ्जन्ति । स यावद्ध वा इन्द्र एतमात्मानं न विजज्ञे तावदेनमसुरा अभिबभूवुः । सयदा विजज्ञेऽथ हत्वासुरान्विजित्य सर्वेषां देवानां श्रैष्ठ्यं स्वाराज्यमाधिपत्यं परीयाय एवैवं विद्वान्सर्वान्पाप्मनोऽपहत्य सर्वेषां भूतानां श्रैष्ठ्यंस्वाराज्यमाधिपत्यं पर्येति य एवं वेद य एवं वेद ॥ कौषीतकिब्राह्मणोपनिषत् ४. २० ॥
>
> The nerves of the heart named hitā extend from the heart of the person towards the surrounding body. Fine as a hair divided a thousand-fold, they stand full of thin essence of various colors, white, black, yellow, and red. In these one remains when sleeping and sees no dream, becoming one with the prāṇa alone. Then speech with all names goes to it, the eye with all forms goes to it, the ear with all sounds goes to it, and the mind with all thoughts goes to it. And when he awakes, then as from a blazing fire sparks proceed in all directions, thus from that self the prāṇas proceed, each towards its place, from the prāṇas the gods (the senses), from the gods the worlds. And as a razor might be placed in a razor-case, or as fire in the fire-place, even so this conscious self enters the body to the very hairs and nails.
>
> On that self depend other selves, as the men follow the chief, or as his own people are of service to the chief, even so these other selves are of service to that self. So long Indra did not understand this self, the Asuras defeated him. When he understood this, striking down and conquering the Asuras, he attained pre-eminence among all gods and all beings, sovereignty and supremacy. And thus also he who knows this obtains pre-eminence among all beings, sovereignty, supremacy — he who knows this, yes, he who knows this. (Kauṣītaki Brāhmaṇa Upaniṣad 4.19–20)

CAUSAL CHAIN AND BIRTH

In Section 4, the Upaniṣad speaks of how the newborn forgets the causal chain at the moment of birth. This echoes the Bhagavad Gītā:

> इच्छाद्वेषसमुत्थेन द्वन्द्वमोहेन भारत ।
> सर्वभूतानि सम्मोहं सर्गे यान्ति परन्तप ।। ७.२७ ।।
> By the rising together of desire and envy from the confusion of duality, all beings, when born, fall into the state of forgetting. (Bhagavad Gītā 7.27)

By doing this, it is able to fit the individual's embodiment in the womb that is consistent with the idea of rebirth.

THE TEXT OF THE GARBHA UPANISAD

> ॐ सह नाववतु ।
> सह नौ भुनक्तु ।
> सह वीर्यं करवावहै ।
> तेजस्वि नावधीतमस्तु मा विद्विषावहै ।
> ॐ शान्तिः शान्तिः शान्तिः ॥
> Om! May we be protected; may we be nourished; may we act together with energy; may our study be vigorous and effective; may we not mutually dispute. Om! śāntiḥ, śāntiḥ, śāntiḥ.

> ॐ पञ्चात्मकं पञ्चसु वर्तमानं षडाश्रयं
> षड्गुणयोगयुक्तम् ।
> तत्सप्तधातु त्रिमलं द्वियोनि
> चतुर्विधाहारमयं शरीरं भवति ॥
> The body is fivefold in nature (the five elements), existing in the five, depending on the six supports (tastes of food), connected with the six qualities, [consisting of] seven dhātus (tissues), three impurities, having two yonis (sexes), and [nourished by] four kinds of food.

> पञ्चात्मकमिति कस्मात् पृथिव्यापस्तेजोवायुराकाशमिति ।
> अस्मिन्पञ्चात्मके
> शरीरे का पृथिवी का आपः किं तेजः को वायुः किमाकाशम् ।
> तत्र यत्कठिनं सा पृथिवी यद्द्रवं ता आपो यदुष्णं
> तत्तेजो यत्सञ्चरति स वायुः यत्सुषिरं तदाकाशमित्युच्यते ॥
> How is it pancātmakam (five-fold)? Because of the five: earth, water, fire, air and

ether. In this five-fold body, what is earth, what is water, what is fire, what is air, and what is ether? It is said that what is hard is earth, what is fluid is water, what is warm is fire, what moves is air, and what is space is ether.

तत्र पृथिवी धारणे आपः पिण्डीकरणे तेजः प्रकाशने
वायुर्गमने आकाशमवकाशप्रदाने । पृथक् श्रोत्रे
शब्दोपलब्धौ त्वक् स्पर्शे चक्षुषी रूपे जिह्वा रसने
नासिकाऽऽघ्राणे उपस्थश्चानन्दनेऽपानमुत्सर्गे बुद्ध्या
बुद्ध्यति मनसा सङ्कल्पयति वाचा वदति ।

There the earth is to support, water is to consolidate, fire is for light, air is for movement, and ether is to provide space. Separately, ears are to receive words, the skin for touch, eyes to see form, tongue for taste, and nose for smell. The genitalia are for pleasure and apāna for evacuation. One cognizes with the intellect (buddhi), envisions with the mind (manas), and speaks with words (vāk).

षडाश्रयमिति
कस्मात् मधुराम्ललवणतिक्तकटुकषायरसान्विन्दते ।
षड्जर्षभगान्धारमध्यमपञ्चमधैवतनिषादाश्चेति ।
इष्टानिष्टशब्दसंज्ञाः प्रतिविधाः सप्तविधा भवन्ति ॥ १॥

How is the six-fold support? It is said to be the six tastes [of food]: sweet, acid, salty, pungent, bitter, and astringent. And ṣaḍja, ṛṣabha, gāndhāra, pancama, madhyama, dhaivata, niṣāda, together with agreeable and disagreeable sounds and prayer, make seven categories (or ten categories, प्रणिधानाद्दशविधा भवन्ति, which is a variant reading).

शुक्लो रक्तः कृष्णो धूम्रः पीतः कपिलः पाण्डुर इति ।
सप्तधातुमिति कस्मात् यदा देवदत्तस्य द्रव्यादिविषया
जायन्ते ॥ परस्परं सौम्यगुणत्वात् षड्विधो रसो
रसाच्छोणितं शोणितान्मांसं मांसान्मेदो मेदसः
स्नावा स्नाव्नोऽस्थीन्यस्थिभ्यो मज्जा मज्ज्ञः शुक्रं
शुक्रशोणितसंयोगादावर्तते गर्भो हृदि व्यवस्थां
नयति । हृदयेऽन्तराग्निः अग्निस्थाने पित्तं पित्तस्थाने
वायुः वायुस्थाने हृदयं प्राजापत्यात्क्रमात् ॥ २॥

It has white, red, black, smoky gray, yellow, tawny and pale as the colors. What are the seven dhātus (tissues) when Devadatta (any person) desires enjoyment of objects? From the proper combination of qualities, six types of chyle (rasa) emerge. From relish of food, blood is created, from it flesh, thence fat, bones, marrow, semen. By the combination of semen and blood the embryo (garbha) is born, and its growth is

regulated by the heart (mother's heartbeat as well as the embryo's).
[The seven dhātus] are in the heart where there's inner fire; at the place of the fire is pitta (bile); at the pitta-organs is movement (vāyu); and at the vāyu-place is the heart, all growing in order according to the law (Prajāpati).

ऋतुकाले सम्प्रयोगादेकरात्रोषितं कलिलं भवति
सप्तरात्रोषितं बुद्बुदं भवति अर्धमासाभ्यन्तरेण पिण्डो
भवति मासाभ्यन्तरेण कठिनो भवति मासद्वयेन शिरः
सम्पद्यते मासत्रयेण पादप्रवेशो भवति ।
When ready, on the joining [of the male and female], [the embryo] after [a day] and night is in a mixed (semi-fluid) state; after seven days it becomes a bubble; after a fortnight, a solid mass, and in a month, it hardens. In two months, it develops the head; in three months, the feet grow.

अथ चतुर्थे मासे
जठरकटिप्रदेशो भवति । पञ्चमे मासे पृष्ठवंशो भवति ।
षष्ठे मासे मुखनासिकाक्षिश्रोत्राणि भवन्ति ।
In the fourth month, belly and hip are formed; in the fifth month, the backbone is formed; in the sixth month, nose, eyes and ears are formed.

सप्तमे मासे जीवेन संयुक्तो भवति ।
अष्टमे मासे सर्वसम्पूर्णो भवति ।
In the seventh month, [the embryo] comes to have the jīva (conscious self), and in the eighth month, it becomes complete in every sense.

पितू रेतोऽतिरिक्तात् पुरुषो भवति । मातुः
रेतोऽतिरिक्तात्स्त्रियो भवन्त्युभयोर्बीजतुल्यत्वान्नपुंसको भवति ।
If the father's seed is more potent, it becomes male; if the mother's seed is stronger, it becomes female. If the seeds are equal, it becomes an intersexual (napuṃsaka, neither male, nor female).

व्याकुलितमनसोऽन्धाः खञ्जाः कुब्जा वामना
भवन्ति । अन्योन्यवायुपरिपीडितशुक्रद्वैध्याद्द्विधा
तनुः स्यात्ततो युग्माः प्रजायन्ते ॥
If [at the time of impregnation] the parents are agitated [that is the seeds of the parents are not in a normal or healthy state], the child will be blind, crippled, hunch-backed or stunted. If the vital air moves around, the seed enters in two parts, resulting in twins.

पञ्चात्मकः समर्थः
पञ्चात्मकतेजसेद्धरसश्च सम्यग्ज्ञानात् ध्यानात्
अक्षरमोङ्कारं चिन्तयति । तदेतदेकाक्षरं ज्ञात्वाऽष्टौ
प्रकृतयः षोडश विकाराः शरीरे तस्यैवे देहिनाम् ।
Enabled by the five-fold self, the intelligence of the five elements emerges, and he meditates on the imperishable syllable Om. With the knowledge of the syllable, he understands the eight natures [five sense organs, the mind, intellect and ego] and their sixteen modifications belong to the self-residing in the body.
अथ मात्राऽशितपीतनाडीसूत्रगतेन प्राण आप्यायते । अथ
नवमे मासि सर्वलक्षणसम्पूर्णो भवति पूर्वजातीः स्मरति
कृताकृतं च कर्म विभाति शुभाशुभं च कर्म विन्दति ॥ ३॥

Whatever is consumed or drunk by the mother passes through the nerves and vessels to the child, becoming the source of his satisfaction. During the ninth month, all outer signs attain completeness. And he is reminded of his previous birth, and recounts the good and bad deeds committed.

नानायोनिसहस्राणि दृष्ट्वा चैव ततो मया ।
आहारा विविधा भुक्ताः पीताश्च विविधाः स्तनाः ॥
जातस्यैव मृतस्यैव जन्म चैव पुनः पुनः ।
अहो दुःखोदधौ मग्नः न पश्यामि प्रतिक्रियाम् ॥
यन्मया परिजनस्यार्थे कृतं कर्म शुभाशुभम् ।
एकाकी तेन दह्यामि गतास्ते फलभोगिनः ॥
He thinks: I have seen thousands of wombs, eaten several kinds of food and sucked many breasts. Born and dead again and again, I am immersed in grief but see no remedy. Thinking of my good and bad deeds, I am suffering alone, although the bodies that enjoyed the fruits are gone.

यदि योन्यां प्रमुञ्चामि सांख्यं योगं समाश्रये ।
अशुभक्षयकर्तारं फलमुक्तिप्रदायकम् ॥
यदि योन्यां प्रमुञ्चामि तं प्रपद्ये महेश्वरम् ।
अशुभक्षयकर्तारं फलमुक्तिप्रदायकम् ॥
When I get out of this womb, I will take refuge in Sāṅkhya-Yoga, which destroys misery and yields liberation; when I get out of this womb, I will take refuge in Maheśvara, who destroys misery and grants liberation.

यदि योन्यां प्रमुञ्चामि तं प्रपद्ये
भगवन्तं नारायणं देवम् ।

अशुभक्षयकर्तारं फलमुक्तिप्रदायकम् ।
यदि योन्यां प्रमुञ्चामि ध्याये ब्रह्म सनातनम् ॥
When I get out of this womb, I will take refuge in Nārāyaṇa, who destroys misery and grants liberation. When I get out of this womb, I will meditate on the eternal Brahman.

अथ जन्तुः स्त्रीयोनिशतं योनिद्वारि
सम्प्राप्तो यन्त्रेणापीड्यमानो महता दुःखेन जातमात्रस्तु
वैष्णवेन वायुना संस्पृश्यते तदा न स्मरति जन्ममरणं
न च कर्म शुभाशुभम् ॥ ४॥
When he reaches the birth canal and comes out of it with great difficulty, he is touched by an all-pervading movement [Māyā] that causes him to forget previous births and the good and the bad deeds performed therein.

शरीरमिति कस्मात्
साक्षादग्नयो ह्यत्र श्रियन्ते ज्ञानाग्निर्दर्शनाग्निः
कोष्ठाग्निरिति । तत्र कोष्ठाग्निर्नामाशितपीतलेह्यचोष्यं
पचतीति । दर्शनाग्नी रूपादीनां दर्शनं करोति ।
ज्ञानाग्निः शुभाशुभं च कर्म विन्दति ।
Why the body is called śarīram. It has three fires — namely, jñānāgni, darśanāgni and koṣṭhāgni. Of these, koṣṭhāgni is that fire which enables the digestion of what is eaten; darśanāgni is the fire that gives the power of seeing forms; jñānāgni is that fire of knowledge which enables one to distinguish between good and bad actions.

तत्र त्रीणि
स्थानानि भवन्ति हृदये दक्षिणाग्निरुदरे गार्हपत्यं
मुखमाहवनीयमात्मा यजमानो बुद्धिं पत्नीं निधाय
मनो ब्रह्मा लोभादयः पशवो धृतिर्दीक्षा सन्तोषश्च
बुद्धीन्द्रियाणि यज्ञपात्राणि कर्मेन्द्रियाणि हवींषि शिरः
कपालं केशा दर्भा मुखमन्तर्वेदिः चतुष्कपालं
शिरः षोडश पार्श्वदन्तोष्ठपटलानि ।
They have three places. At the heart is the dakṣiṇāgni, in the belly is the gārhapatya, in the mouth is the āhavanīya. The ātman is the yajamāna (sacrificer); intelligence is the mistress; the mind is the Brahmā (the doer); greed and so on [anger, jealousy] are animals [of sacrifice]; mental strength is the vow; contentment and the organs of intellect are the instruments of the yajña (sacrifice); the action organs are the sacrificial objects (comparable to the havis or the rice); the head or the skull is the utensil; the hair thereon is the darbha (the dried grass used in homa); the mouth is the inner altar, the head are the four cups, and the two rows of teeth are the sixteen cups (kapāla) [of

the sacrifice].

सप्तोत्तरं मर्मशतं साशीतिकं सन्धिशतं सनवकं स्नायुशतं
सप्त शिरासतानि पञ्च मज्जाशतानि अस्थीनि च ह
वै त्रीणि शतानि षष्टिश्चार्धचतस्रो रोमाणि कोट्यो
हृदयं पलान्यष्टौ द्वादश पलानि जिह्वा पित्तप्रस्थं
कफस्याढकं शुक्लं कुडवं मेदः प्रस्थौ द्वावनियतं
मूत्रपुरीषमाहारपरिमाणात् ।

[The human body] consists of 107 marmas (weak or sensitive spots), 180 sutures or junction points, 109 snāyu (sinews), 700 channels, 500 majjā (muscle), 360 bones, and forty-five million hairs. The heart weighs 8 palas and the tongue weights 12 palas. It has one prastha of pitta (bile), one āḍhaka of kapha, one kuḍava of śukra, and two prasthas of fat. The measure of the urinary or solid excretions is dependent on the intake. [1 pala = 45.5 grammes; 1 prastham = 728 grammes; 1 āḍhakam = 2,912 grammes; 1 kuḍava = 182 grammes].[5]

पैप्पलादं मोक्षशास्त्रं
परिसमाप्तं पैप्पलादं मोक्षशास्त्रं परिसमाप्तमिति ॥

This Mokṣaśāstra was enunciated by the sage Pippalāda. This Mokṣaśāstra was enunciated by the sage Pippalāda.

ॐ
सह नाववत्विति शान्तिः ॥
इति गर्भोपनिषत्समाप्ता ॥

NOTES

1. Deussen, Bedekar and Palsule (1997).
2. Kak, The Astronomical Code (2016).
3. Kak, Mind and Self (2016)
4. Kak, The Loom of Time (2016).
5. The conversion ratios are from Deussen's *The Philosophy of the Upanishads*, page 285.

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Ritual, Masks, and Sacrifice*

INTRODUCTION

Ritual is intimately connected with the mask, either in the wearing that hides the true face, or in the adoption of a public face. The mask makes the disengagement from ordinary time and the connection to the ancient and repetitive, which is the heart of ritual, psychologically acceptable. Together, ritual and mask facilitate the apprehension of identity and its connections with paradox by placing the mystery of change outside of life's ordinary reasonableness into the domain of magic and power. This change and transformation is enacted by the sacrifice of the ritual.

The question of transformation is also related to cognitive categories, sexual identity, and violence. There is not only aggression and violence in Nature (as in the *matsyanyāya* of the big fish eating the smaller fish), but also within the human soul. It is in the human nature to own and command, and this sets up a struggle with other individuals. Rousseau's idea that man is fundamentally good as in his famous slogan "Man is born free, and everywhere he is in chains", led to the naïve view that violence is a consequence of social ills alone. But society only embodies that already exists as potential in each individual, and violence is a fundamental impulse of life. Hobbes and Sade represent ancient psychological views more accurately than Locke, Rousseau, or contemporary liberals.

Ritual recreates the universe in a symbolic mirroring whose structure depends on the cosmology underlying the culture. It helps shift perspective from the outer to the inner. Reconciliation to loss may be easier if one acknowledges that subjective *facts* are constructions of the mind. The creation of internal reality by the mind is confirmed by the consideration of altered states of consciousness. It is for these reasons that masks help one to confront the questions of identity and personhood.

Visions of the end of the world flavour the grammar for much ritual and sacrifice. There exist two main views, centered about permanence and change, respectively. In the first, the end leads to the resurrection of the body; in the second, the spirit goes through cycles of change. Conflicting body-centric visions of the end of the world are at the root of the ongoing war in the Middle East. The vision of a permanent body maps to a word-centric tradition, whereas those who consider change as part of natural law use images, since the image is a snapshot of a dynamic sequence.

Sacrifice, as recreation of the order in the universe, can be of two kinds: either literal, in a mirroring of the idea of a permanent life after death; or symbolic, where it is sacred theatre to represent the larger *play of the gods* in the universe. Sacrifice and killings continue

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as part of human society and one can see it most clearly in the relationship between man and animals.

In this essay, I consider themes related to ritual, masks, and sacrifice to illuminate aspects of culture in the past and in our own times. This consideration includes the contemporary treatment of animals, the traditional victims of sacrifice.

PERSON AND MASK IN THE WEST

In Rome, the term *persona* applied to individuals who had full citizenship, determined by membership of recognized descent lines or lineages. Such families had to demonstrate possession of *simulacra* and *imagines*, which were death-masks of the ancestors, cast in wax, though in a wider sense they were also the ghosts of the dead. As representations of ancestral faces, the *simulacra* and *imagines* were kept in the *lararium*, the family shrine in cupboards or hung from the wall. It was in their watchful presence that initiation ceremonies of the youth were performed. At funerals, the masks were worn by professional actors who publicly performed the deeds of their lives. Sometimes ancestral *imagines* were hung at the four corners of the funeral bier. The *persona* therefore represented the individual who could validate his social identity through the lineage, and this contained in it ideas such as that of reincarnation and serial succession.

Masks were used by actors for dramatic effect to convey danger, mystery, and to facilitate the sense of transformation in the viewer's mind. The actor could take the persona of gods, demons, or of animals. It also made it possible to show killing in symbolic terms, with great power.

With the rise of Christianity, its underlying duality brought the notion of *possession* to the fore. In addition to the good people who waited patiently for the Day of Judgment to enjoy their everlasting life, bad people became *larvae*, who could return to possess and torment living people. In 643, there is declaration by the King of the Lombards that killing witches was justified. The term *masca* became synonymous with witches. Before this, the Church Councils had already condemned the practice of masking, especially as *cervuli* (horned animals) and *vetulae* (old women). Masking represented the power of alteration of identity, which was especially reprehensible if it transformed into animals or women. Cesare Poppi summarizes:[1] "The Middle Ages believed in miracles, but only in those transformations of the order imposed by God on Creation that could be related, one way or another, to that original *transformatio* that was the Eucharist, i.e. the mystery of the death and resurrection of Christ. The rest, any other 'masking' of the divine imprint on Creation, was diabolical. And not only the Devil was himself 'a mutant', but he was a mask, a false appearance in need of constant re-masking due to the as many exposures he had to undergo. In this respect, he was *the* non-identical, *the* confounder, *the* Great Liar – and he lied first of all about himself and his appearance."

The agency within, if it was in conflict with the plan of the Church, became a sign of the devil. Consequently, art and sciences suffered serious circumscription and Europe was

plunged into the Dark Age. According to David Napier:[2] "[W]hat distinguished medieval visual representations was the conviction that all ambiguous personifications save the Trinity were both morally unacceptable and categorically harmful... For Christians, an all-knowing god cannot be moved by mimesis; transformation through visual performance and supernatural omniscience must remain antithetical. For the Middle Ages, the body itself became a persona---a mask that its wearer only escaped at death."

With the breakdown of materialism as the basis of science and the rediscovery of the inner world of the mind, the modern man's sensibility has become receptive to ancient artistic expression, making ritual more accessible. But this increased accessibility has not always been accompanied by greater understanding, which explains the ambivalence towards it on the one hand and the passionate embrace of the irrational on the other. From this perspective we find that the current religious strife is not unrelated to the attitudes springing out of the paradoxical in science.

SEX, VIOLENCE AND ART

First time visitors to America can't fail to be struck by the prominence that sex and violence have in the arts, the media, and popular culture. Some see in this signs of decadence; others view it as birth pangs of a new, more humane culture of knowledge, the necessary evil that heralds a new golden age.

A myth popularized by modern-day utopians is that if only oppressive, paternalistic institutions were dismantled, an ideal and perfect society would be created. The left holds capitalistic organizations responsible not only for social ills but even decadence and violence. The establishment feminists believe that if the young were to be properly raised, all problems related to gender will be eliminated. The reduction of the power of paternalistic institutions is seen behind the advancement of the previous century toward equal rights for women, spread of education, and reduction of poverty and hunger. Other advancements adduced are the freeing of women from 'male-encouraged' practices such as binding of feet (China), wearing of corsets (West), and the veil.

But the progress that has occurred is not only a result of cultural change, but also of industrial revolution. Machines at home freed up women to work in the marketplace. In the service industry, women could work as equal to men, empowering them in the process. But women may have been freed from corsets, only now they wear five-inch high stiletto heels.

Acknowledging violence as a part of the human condition helps a culture to devise ways to confine it to the theatre of the mind. Ignoring the individual's propensity for violence we run the risk of continuing the mistakes that made the last century one of the most bloody in history.

In rich societies, violence has taken new forms. There are massacres by schoolboys, violence to oneself through drugs and self-mutilation, even cannibalism. At colleges, young people pierce their tongues, eyebrows and other organs, not because paternalistic institutions demand it but because it is 'cool' to do so. Then there is violence arising out of despair, greed, and envy.

More traditional societies have their own gallery of horrors. Consider the terror of the last decade in Afghanistan, Pakistan, the Balkans, Rwanda, and Algeria, where throats have been slashed, people burnt to death, and women raped on a wide scale. Entire communities have been massacred.

Violence arises out ignorance, by a misidentification with the animal self within. Nature transcends the dichotomy of good and evil. Beauty softens the horror of this, taking our minds into imagination and the domain of divinity. Art, as representation of beauty, intimates transcendence beyond the humdrum.

Modern life alienates us from Nature, even our own. Culture is a structure that keeps the animal instincts of man at bay, by appealing to reason and higher meaning. But modern education does not prepare the young to understand differences in gender and culture. Biological cycles confirm the primacy of Nature over self. The menstruation cycle, in accord with the motions of the moon, is the most dramatic example of this, but there are other cycles too. We are tossed about by forces within us over which we have very little control. Since the woman gives birth, the primacy of Nature was celebrated in the ancient world through the symbol of the Goddess.

Greek plays were staged to celebrate and honor Dionysus (paralleling this, Indian plays invoke Shiva), who holds in him both the fearful powers of the mind and creativity and freedom. In contrast to him stands Apollo, the personification of order, tradition and culture. The Dionysian creative energy requires a structuring by the Apollonian form for the Apollonian, in itself, is mechanical.

If Apollo is the god of the moral universe and the law, Dionysus is the patron of music, dance, and the creative arts. But moral law must be grounded in freedom which, in turn, has to be given shape by reason, and thus the two gods need each other. There is also the further polarity between them and the goddess, who nourishes and protects.

Those who accept the primacy and mystery of Nature are Dionysians, others for whom law and moral order are central are the Apollonians. These complementary views, after the Greek gods Dionysus and Apollo, are akin to those of Shiva and Vishnu. Shiva's dance creates and destroys the world whereas Vishnu by his moral law sustains it. This complementarity was recognized by the Greeks who came to India with Alexander (who believed that Indian religion was essentially identical to the Greek), and it is explicitly recognized in the conception of *Harihara*, a fusing of Vishnu and Shiva, that became popular in Southeast Asia.

The further complementarity of the God and the Goddess is through the idea of the God's consort and the divinity who is half-male, half-female, *Ardhanārīśvara*. The God provides the framework for moral order and deepest intuition, whereas the Goddess provides the inspiration that makes transformation possible. In a recursive playing out of structure, within each sect there are the right-hand and left-hand ways.

Divinity in the pagan world is hierarchical. The gods stand above the titans just as the *devas* are above the *asuras*. The world of Apollo is a projection of the mysteries of Dionysus. Reality is the dance of Shiva on the cosmic body of Vishnu; this dance is produced

by the power of *māyā*.

The pagans of the West also understood this complementarity, but with the defeat of Old Religions in Europe, Egypt, and the Near East began a rejection of Nature and of the Goddess as a symbol of Nature. Society went from a glorification of now and here to that of hereafter and death, from a glorification of knowledge to the idea of everlasting life in paradise.

Religious beliefs can be put in three classes: (1) Vedic or pagan, where the complementarity of Vishnu and Shiva or Apollo and Dionysus is understood; (2) Sky religions, which decry earth and the Goddess, where ultimate meaning is to be found in paradise after death; (3) Earth religions, where there is no moral counterbalance of Nature. The Vedic and pagan religions give weight both to the aesthetic of the word and the eye, the Sky religions value just the word, and the Earth religions worship the image alone. It is the interplay between these religions and aesthetics that leads to the development of art in different styles. It will also be clear that great religions have many diverse currents.

Camille Paglia equates classical antiquity with the visual aesthetic which she calls paganism. During the Middle Ages in Europe (Dark Ages) when strict Christianity ruled, images were outlawed in favour of the word. Slowly Catholicism, with its own florid images, became increasingly pagan. Protestantism was a reaction to Catholicism, an attempt to return to the primacy of the word. Modernity is the swing back to paganism and its visual mode. By now Judaism and Christianity have come to terms with images.

The history of Western art, literature, and popular culture may be viewed as a struggle between the two poles of word image. Paglia says:[3] "The most ancient conflict in western culture, between Jew and Egyptian, continues today: Hebrew word-worship versus pagan imagism, the great unseen versus the glorified thing."

In word-cultures Nature is the other, to be controlled and exploited. This is mirrored in a subordination of women, a rejection of graphic and representational art, and a rejection of mythology. In societies where the aesthetic of the word is taken to an extreme, women are completely segregated and even relatives may be 'killed for honour'; there is a rejection of words outside of the sacred circle and, consequently, a rejection of history of other circles.

Religious war is a war between two different aesthetics. The Mughal emperor Jahangir in his *Jahāngīrnāmā* calls[4] "Vedanta the science of Sufism", yet he has no compunction in destroying the image of the Varāha in the important pilgrimage centre at Pushkar[5] to show his disapproval of that artistic representation of divinity.

Paglia summarizes[6], "Paganism is pictorialism plus the will-to-power. It is ritualism, grandiosity, colossalism, sensationalism. All theater is pagan showiness, the brazen pomp of sexual personae. Judaism's campaign to make divinity invisible has never fully succeeded. Images are always eluding moral control, creating the brilliant western art tradition. Idolatry is fascism of the eye. The western eye will be served, with or without the consent of conscience. Images are archaic projection, earlier than words and morals. Greco-Roman personality is itself a visual image, shapely and concrete. The sexual and psychological deficiencies of Judeo-Christianity have become blatant in our own time. Popular culture is

the new Babylon, into which so much art and intellect now flow. It is our imperial sex theater, supreme temple of the western eye. We live in the age of idols. The pagan past, never dead, flames again in our mystic hierarchies of stardom."

The Taliban regime in Afghanistan may have been the last stand of the word-only idea that rejected all images. In the pursuit of its goal, it was compelled to ban TV and destroy the images of the Buddha in Bāmiyan. Other Islamic countries, like Saudi Arabia and Pakistan, have been unable to stop the assault of the eye-aesthetic through books, magazines, TV and the Internet. They may not acknowledge it, but they are becoming increasingly pagan in the sense of imagism.

RITUAL AND PARADOX IN INDIA

Indian ritual also involves a specialized vocabulary with layers of meaning and a deliberate use of paradox. Here words serve as masks. Vedic texts are replete with paradoxical images for the communication of a transcendent understanding. We see the continuation of such usage in the poetry of the medieval saints of India, where this language was called *sandhyā-bhāṣā*.

The earliest Indian rock art that predates the Harappan civilization has figures wearing masks. Terracotta masks have been found in Harappa; these include a goat mask. In the Nāṭya Śāstra, colored paste (*mukharāga*) was applied by the actor on the face to communicate the emotion and identity required for the performance. Identity had a social component, which is why it was defined by the reaction it evoked. This set it partly as a choice made by the individual within the circumstances of his social situation. Identity also had a temporal component related to the continuing changes within. These changes, if deliberate, were termed sacrifice, and they were set in terms of various grand stages of life, and also smaller stages represented by various *saṃskāras*.

The term *sacrifice*, with its common meaning of "killing to offer to God or gods", is cause of much misunderstanding of the Vedic ritual. Vedic *yajña* (sacrifice) need not involve any killing of animals. It is a highly symbolic performance, and the animals of the sacrifice may be clay images or grains; or they may just be specific utterances. The Chāndogya Upaniṣad, speaking of Revati Sāmans says, "The *hiṅkāra* is goats, the *prastāva* sheep, the *udgītha* cows, the *pratihāra* horses, and the *nidhana* puruṣa" (CU 2.6.1; 2.18.1). In other words, the different parts of the song are compared to different sacrificial animals.

When an animal is sacrificed in the ritual, we are speaking of mock killing in sacred theatre. The word "killing" is described in the texts to apply equally to the pressing of the soma stalks and the grinding of the grain (TS 6.6.9.2, SB 2.2.2.1-2, 4.3.4.1-2, 11.1.2.1). The normative meaning of the term is symbolic. I recently analyzed[7] the basis of Aśvamedha ritual for its theological, psychological and astronomical basis.

The Vedic view acknowledges that all creation is interdependent. Just as the self (ātman) is mystically equivalent to the universe (Brahman), the body has within it all creatures. Of the principal animals conceived within the body, the horse represents time. The horse-sacrifice is then the most mystical and powerful, because it touches upon the mystery

of time, which carries within it the secret of immortality.

The sacrifice of the animals is the enactment of the killing of the mortal lower self for a transformation into the immortal higher self. Since the higher self cannot manifest itself without the lower one, one must settle for something less, a ritual rebirth of the individual. In other words, sacrifice deals with mastery of time.

There have been several modern scholarly studies of the concept of sacrifice. According to one view, sacrifice provides a means to the community to redirect feelings of violence and aggression, saving it from collapse. Sacrifice is then a social construct of great use, and it has elements of competition and gift-giving woven into it. The victim is both outcast and saviour, and being separate from others, the king is often the ideal (but not real) victim. This may explain elements of sacrifice in many societies, but it does not explain Vedic sacrifice.

The distinctiveness of Vedic sacrifice comes from many reasons of which the following two are the main ones: (i) Its ambiguities are deep, and it operates at several levels, including the spiritual; and more uniquely, (ii) it posits an identity of the sacrificer and the universe. This latter idea is perhaps why the "knowledge" central to the sacrifice becomes, in the end, the purpose of the sacrifice and the vehicle of the transformation of the participants. The "theatre" aspect of the ritual is, therefore, considerably accentuated.

SACRIFICE AND SACRED THEATRE

The central idea behind the Vedic system is the notion of *bandhu* (bindings or connections) between the astronomical, the terrestrial, the physiological, and the spiritual[8]. These connections are described in terms of number of characteristics, such as the 360 bones of the infant (which later fuse into the 206 bones of the adult) and the 360 days of the year. In a similar vein, the Garbha Upanisad says that the body has 180 sutures, 900 sinews. The Bṛhadaraṇyaka Upaṇisad takes the number of *nāḍis* to be 72,000. All these numbers are related to 360, the nominal day count of the year.

Another central Vedic number is 108. Its astronomical basis is that the sun and the moon are approximately 108 times their respective diameters away from the earth. Furthermore, the diameter of the sun is approximately 108 times the diameter of the earth. The number 108 is also taken to represent the 'distance' from the body of the devotee to the Īśvara within. The chain of 108 'links' is held together by 107 joints, which is the number of *marmas*, or weak spots, of the body in Ayurveda. . The Nāṭya Śāstra speaks of the 108 *karaṇas* -- combined movements of hand and feet -- of dance.

We can understand that the 108 beads of the rosary (*japamālā*) must map the steps between the body and the inner sun. The devotee, while saying beads, is making a symbolic journey from the physical body to the heavens or getting a measure of Īśvara through his own self. This explains the tradition of the 108 names of divinity. The number 108 appears in many other settings in the tradition, including temple architecture.

One can see a plausible basis behind the equivalences between the microcosm and the macrocosm. Modern research has shown that all life comes with its inner clocks. Living

organisms have rhythms that are matched to the periods of the Sun or the Moon. There are quite precise biological clocks of 24-hour (according to the day), 24 hour 50 minutes (according to the lunar day since the Moon rises roughly 50 minutes later every day) or its half representing the tides, 29.5 days (the period from one new Moon to the next), and the year. Monthly rhythms, averaging 29.5 days, are reflected in the reproductive cycles of many marine plants and those of animals. The menstrual period is a synodic month and the average duration of pregnancy is nine synodic months.

It is reasonable to assume that the Vedic thinkers were aware of these connections, as were the ancient people in other cultures. The uniqueness of the Vedic vision was the extension of the bindings to the body to those in the inner landscape of the spirit. The Vedic rites were meant to help the participant transform themselves through sacrifice. The rishis saw the universe as going through unceasing change in a cycle of birth and death, potentially free yet, paradoxically, governed by order. This order was reflected in the *bandhu* between the planets, the elements of the body, and the mind. At the deepest level, the whole universe was bound to, and reflected in, the individual consciousness.

Vedic ritual is a highly systematized performance of various elements that include manipulations, formulas, liturgy, exchanges, where some of these elements are varied according to the specific rite. These elements have symbolic significance. The basic pattern is that of the preparation or offering of one or more cakes or bowls of porridge.

The place of sacrifice represents the cosmos. Three fires are used, which stand for the three divisions of space. The course of the sacrifice represents the year, and all such ritual forms part of continuing annual performances. The rite culminates in the ritual rebirth of the *yajamāna*, which signifies the regeneration of his universe. It is sacred theatre, built upon paradoxes of reality, where symbolic deaths of animals and humans, including the *yajamāna* himself, may be enacted.

The mystery of the sacrifice, with its suspension between life and death, reality and magic, logic and mystical experience is communicated in a language which is full of riddles. For example, it is stated that Prajāpati is Agni's father, but he is also Agni's son (SB 6.1.2.26); also, the gods sacrificed to the sacrifice with the sacrifice (RV 1.164.50).

The sacrifice is not the drama associated with it, but rather the transformation accruing from it. Says Kena Upanisad 2.3: “He by whom Brahman is not known, knows it; he by whom it is known, knows it not. It is not known by those who know it; it is known by those who do not know it.”

Vedic ritual is also related to the ongoing struggle between the devas and the asuras, where the devas represent the higher cognitive centers in man, and the asuras represent the lower centers that are associated with the body. Viewed as independent agents, the asuras are materialists, content with the identity of the body with their self; this is described aptly in the dialogue between Prajāpati, Virocana, and Indra (CU 8.7-14). The devas need to subdue the asuras to establish order. The asuras are older because the body comes first; the devas are the younger descendants of Prajāpati (BU 1.3.1).

The prototypical sacrifice is that of Vṛtra, who represents the covering that separates

the individual self from the inner Sun (SB 1.1.3.4). Indra, as the deity of the atmosphere, must make this sacrifice. Indra kills Vṛtra by the offering of a cake (SB 5.2.3.7). We must be cautious and not read the descriptions of ritual literally. The ritual books have enough warnings about the paradoxical aspects of the performance.

Sacrifice allows the participant to bridge the divide of the body and the spirit and be transformed. But to the outsider the performance can be viewed in *asuric* terms, or correctly (*daivika*). The *asuric* reading is literal; the correct one transcends simple dichotomies.

This is stressed most clearly in the Īśa Upaniṣad. One is enjoined not to consider either the material or the abstract spiritual reading the correct reading. Ritual requires performance and that is the material or the avidya part of it, but that, in turn, becomes the ground for the transcendent meaning: "He who knows at the same time both the spirit (*sambhūti*) and the destruction (*vināśa*), overcomes death by destruction and obtains immortality through the spirit." (IU 14)

Unfortunately, to a beginner trying to understand the Vedic system, the *asuric* position appears most natural. This is responsible for much misunderstanding of Vedic rites and their meaning in the West.

SACRIFICE AND MASSACRE SOCIETIES

We shift our focus from India to the New World where the paradigm is that of permanence. With the fear of dying behind notions of bodily ascension to paradise, the blood sacrifice is a grand gesture to impress upon the Unknown to fulfill wishes.
In a study of the conquest of America by Spaniards, Tzevetan Todorov felt the need to postulate two kinds of society[9]. Noting the allegation that 80,400 persons were sacrificed in Mexico by King Ahuitzotl during the inauguration of a single temple, and that there was widespread genocide of the native Indians so that in Mexico their population is estimated to have gone down in the century after the arrival of the Spaniards from 25 million to one million, Todorov called them sacrifice-society (Mexicans) and massacre-society (Spaniards).

The identity of the victim of religious murder in a sacrifice-society is determined by strict rules. He is not too alien, and he speaks the same language but, politically and socially, he is part of an autonomous group. His sacrifice testifies to the inferiority of his clan or religious belief. In Europe, the killing at the stakes by the Inquisition was sacrifice.

On the other hand, massacre is linked to alien individuals far from one's country. The individual identity of the victims does not matter. The victims are treated as less than human. Indeed, the Indians in the New World were not given legal human status by the Pope until 1530. The massacres are dissimulated and denied. Wars of colonialism, away from the metropolitan country, are wars of massacre.

Todorov also spoke of the modern totalitarian state that has elements of both sacrifice and massacre. Here, the killing is done on the home ground, but there is no ritual associated with it. There is no vision of everlasting life in heavenly paradise; rather, a vision of a paradise on earth where the facilitators of the regime will be forever remembered. The Nazi and the Communist regimes belong to this category.

MAN AND BEAST

I shift to the question of the relationship between man and beast –the traditional victim of sacrifice -- in modern society, and I will do this by means of an impressionistic account of a visit to a high-security prison rodeo in Louisiana. It was organized as a fundraiser for prisoners so that they could continue to ride horses and run their workshops. The prison itself is situated on high ground and the prison property is so large that you can see the skies to the horizon in all four directions.

After entering the main gate the road slopes gently upwards for miles, as if this were the navel of the earth. The vastness of the grounds, very little tree cover, high watchtowers and a razor-topped wire fence around must make the inmates feel that they are at the end of the world.

We didn't get to see the actual accommodations of the inmates, but from the documentaries I have seen on such facilities, it is clear that the idea is to cage them and compel the beast in them to submit to the stronger will of society. The reward for good behaviour is permission to work in the workshops.

Some may not like the characterization of the beast within, but I believe that not only the criminal but the rest of us also have an animal lurking within who is kept in check by fear of retribution and the civilizing force of culture and habit. The rate of incarceration is different from nation to nation and it seems to set the tone for civil behaviour. Currently, there are about 800 prisoners per 100,000 people in America and about 35 per 100,000 in India.

The notion of the animal within is acknowledged in Indian thought in the idea of the *asuras* who precede the gods. The *asuras* take the body to be everything, whereas the gods seek higher meaning. Without culture and self-discipline, we are *paśu* (animals). When our habits (*pāśa*) that bind us down to our animal nature are broken, we become truly human (*paśupati*).

To come back to the rodeo, the stands were packed with visitors from far and wide. One section was separated by a chain link fence from the others; this is where the prisoner-spectators sat. Other prisoners in striped shirt uniforms were helping in the supervision of the show, some others were participants in the rodeo competitions for pride and good points.

There were stalls where one could buy handicrafts including leatherwork, clocks, and woodwork made by the prisoners. Food and drink stalls sold hot-dogs, hamburgers, funnel-cakes, cotton candy, ice cream and other treats to entice young and old. It felt somewhat like a village fair, but not quite so.

The difference was perhaps the nature of the contests -- the rough rides, and the riders being thrown, trampled upon, and gored. In one contest, four ‘poker players’ sat a table in the arena and a frightened bull was let loose, the victor being the person who moved last. The bull was goaded to attack the players and he tossed the players, one by one, several feet into the air with his horns. There was something in the air reminiscent of the contests of ancient Rome.

Many participants were limping or walked stiffly, a few were carried away in

stretchers. Some, in spite of obvious injuries, kept on returning, driven by jailhouse bravado. The rodeo is one of the few places in modern living where we see animals and men interact on somewhat of an equal basis. The zoo does not achieve this because of the asymmetry of its situation. These apart, the modern man knows animals from TV shows or as pets, or from their packaged body parts in grocery stores.

Jeffrey Masson has reviewed[10] scientific research that shows that animals in the wild or in captivity experience emotions of love and anger, suffering and loneliness, jealousy and disappointment. Animals are curious, they worry, they hate, and they anticipate happiness. I have personally seen a bull separated from its long-time companion shed big tears in obvious grief.

If we don't interact with animals, how would we know if there is an ethical way of treating them? Granted that all life is part of a food chain; don't we still need to ensure that there is no unnecessary cruelty and violence in our interactions with them?

I am not one to argue for absolute non-violence as even farming requires the killing of worms and pests. Nor am I arguing for vegetarianism. (As an aside, a case for vegetarianism could be made based on production efficiency and on compassion for life. But not everyone has the same sensibility and, therefore, there should be no compulsion in dietary matters.)

One could base the treatment of animals on the principle that each species should be allowed to live in conditions as natural as possible. It is only in such conditions that we could hope for the animal to realize its biological purpose. There may be important lessons to be learnt about nature of mind, behaviour, and biology that could be invaluable to man's own survival. Being compassionate to animals is not entirely altruistic. On the other hand, treating animals with cruelty not only dulls our own sensibility but may also lead to dangerous diseases. Giving cows feed made out of dead cows led to the incurable mad-cow disease.

Until recently, man and animal lived in some kind of equilibrium. Everyone saw death, either of one's own kind, or of animals in ritual slaughter and in hunting. The mechanization of raising and killing animals has destroyed this equilibrium.

Animals are raised in factories, in most unnatural conditions. Their diet is unnatural. Beef cattle in the United States are raised at feedlots after they have turned six months old. Here, in further eight months, they are fattened to over twelve hundred pounds and then slaughtered.

The feedlots are like enormous cities of cattle with tens of thousands of residents. They are taken off hay and grasses, and fed corn, antibiotics, steroids, and vitamins (which may be animal in origin). The sanitation is shocking. The animals wallow in their own refuse and a cloud of fecal dust hangs around. The digestive system of the animals is not suited to the corn feed and it leads to several diseases which are kept suppressed by the steady feed of antibiotics. American houses and cities might be clean but where the animals are grown is horribly unclean.

Similar animal factories are being used to raise chicken, pigs, catfish where these animals hardly ever move once they are born, because of the crowding. Peter Singer in his

Animal Liberation argues[11] that those who oppose human suffering must also oppose inflicting pain on animals. But animals in military, scientific, and commercial enterprises are often put through unnecessary pain.

The treatment of beef cattle in meat factories is ethically indefensible and it has arisen out of a system of subsidized corn production and relentless and mindless pursuit of profit. It has been calculated that to fatten a steer in eight months of stay at a feedlot requires corn grown with the help of fertilizer made out of about 280 gallons of oil. Since oil is extremely cheap in the US compared to Russia and Argentina, the meat produced in those countries cannot compete in price. Fossil fuel based agriculture in the US may have contributed to the collapse of the Soviet Union and the continuing crisis in Argentina.

Singer tells us that during pregnancies sows are confined in stalls that do not permit them to turn around and walk to and fro. The veal calf will spend its whole life constrained to a pen so its anemic muscles will remain tender when butchered. This calf is not even provided enough space to lie down.

The workings of American meat factories warn us of a new danger of globalization. Logic of efficiency taken to extreme limits without regard to humaneness and compassion will create conditions that deaden the soul.

CONCLUSIONS

The study of the cognitive categories of the past has lessons for the understanding of the present. The more we have been changed by science and technology, the more we have remained the same. Our ancestors grappled with the paradox of reality in two different ways: either by postulating a permanent self that made the consideration of images and masks illegal or dangerous, or by the consideration of a self that is forever going through the process of change. They knew these two sides represent complementary aspects of reality.

Modern societies may have largely abandoned old ritual. The new ritual that has taken its place is not organized by the priesthood of a religion; it is amorphous and ever-changing, disseminated through movies and music. Its Dionysian elements are provided by alcohol and drug parties; its Apollonian elements are the framework of the life ethic and the new movies that launch myths and stars. The violence going on in the wars being fought at numerous places around the globe offers the sacrifice and massacres of the blood offerings.

The new masks of the times are the airbrushed faces of the models on TV and billboards. These images present a constructed reality that is now the standard that people in real life try to emulate. The ritual of ordinary life is to conform to the rhythms of the machines around and engagement with pop-culture. Meanwhile, killing of animals is not to be seen in real life, although upon it is based the entire food industry.

NOTES

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24
Gautama on Logic and Physics*

INTRODUCTION

Physics as part of natural science and philosophy explicitly or implicitly useslogic, and from this point of view all cultures that studied nature [e.g. 1-4] must have had logic. But the question of the origins of logic as a formaldiscipline is of special interest to the historian of physics since it represents aturning inward to examine the very nature of reasoning and the relationshipbetween thought and reality. In the West, Aristotle (384-322 BCE) is gener-ally credited with the formalization of the tradition of logic and also with thedevelopment of early physics. In India, the Rgveda itself in the hymn 10.129 suggests the beginnings of the representation of reality in terms of variouslogical divisions that were later represented formally as the four circles of *catuṣkoṭi*: "A", "not A", "A and not A", and "not A and not not A" [5]. Causality as the basis of change was enshrined in the early philosophical system of the Sankhya. According to Puranic accounts, Medhātithi Gautamaand Akṣapāda Gautama (or Gotama), which are perhaps two variant names for the same author of the early formal text on Indian logic, belonged toabout 550 BCE.

The Greek and the Indian traditions seem to provide the earliest formalrepresentations of logic, and in this article we ask if they influenced eachother. We are also interested in the scope of early logic, since this givesan idea to us of the way early thinkers thought about nature and change. We will show that Greek and Indian logical traditions have much that isdistinctive and unique.

Philosophy and physics were considered part of the same intellectual en-terprise until comparatively recent times. Thomas McEvilley's *The Shape of Ancient Thought* does an excellent comparative analysis of Greek and Indianphilosophy [6], stressing how there existed much interaction between the twocultural areas in very early times, but he argued that they evolved indepen-dently. Some scholars believe that the five part syllogism of Indian logic wasderived from the three-part Aristotelian logic. On the other hand, there is an old tradition preserved by the Greeks and the Persians which presentsthe opposite view. According to it, Alexander was the intermediary whobrought Indian logic to the Greeks and it was under this influence that thelater Greek tradition emerged. In this article, I review the evidence afresh and conclude that althoughthe Greeks may have been aware of Indian logic, there is no reason to supposethat it influenced their own development of the subject in any fundamentalway. I argue that the five-part Indian syllogism is likely to have been anearlier invention than Aristotle's work. These conclusions can assist us infinding the chronological framework for the development of logic within India.

* ArXiv (2005)

BACKGROUND

My interest in the question of the connections between Indian and Greeklogic was triggered several years ago by a letter from Andrei Heilper of the IBM Research Laboratory in Haifa, Israel. Heilper felt that Western logicmight be indebted to Indian logic but this feeling was based on secondaryevidence, and he wanted to know if I could help him reach a more definitive conclusion. Heilper's interest in Indian logic was born out of a passage in the book *The World as Will and Representation* [7] by the German philosopher Arthur Schopenhauer (1788-1860), who was commenting on the reference by theIndologist William Jones (1746-1794) on this matter.

William Jones has the following account on the question of the relationship between Indian and Greek logic (it appears in the 11th discourse):[2]

> Here I cannot refrain from introducing a singular tradition, whichprevailed, according to the well-informed author of the "Dabistan", in the Panjab and in several Persian provinces, that, "amongother Indian curiosities, which CALLISTHENES transmitted to his uncle, was a technical system of logick, which the Brahmenshad communicated to the inquisitive Greek," and which the Mohammedan writer supposes to have been the groundwork of the famous Aristotelean method: if this be true, it is one of the mostinteresting facts, that I have met with in Asia; and if it be false,it is very extraordinary, that such a story should have been fabricated either by the candid MOHSANI Fani; or by the simpleParsis Pundits, with whom he had conversed; but, not having hadleisure to study the Nyaya Sastra, I can only assure you, that Ihave frequently seen perfect syllogisms in the philosophical writ-ings of the Brahmens, and have often heard them used in theirverbal controversies.

Kallisthenes (370-327 BCE), a relative of the philosopher Aristotle, wasthe court historian to Alexander who was a member of the campaign. Hewas executed by Alexander in 327 BCE. There exists credible evidence thatKallisthenes was asked by Aristotle to bring texts to Greece. Since his bring-ing back of the astronomical observations of the Babylonians is attested byseveral sources, it is reasonable to assume that the story about his havingbrought back Indian logic is also credible. But this cannot be taken to meanthat the texts of Indian logic directly or indirectly influenced Aristotle.

The relevant passage from the *Dabistan-i Madhahib* (School of Sects), a17th century text by Mohsan Fani, a Kashmiri scholar of Persian ancestrywho lived during 1615 - 1670 (?) [8, pages 270-273]:

> Tark sastra is the science of dialectics; ... These are the sixteen parts of the Tarka. The followers of this doctrine judge and affirm that, as this world is created, there must be a Creator; the *mukt*, or "emancipation," in their opinion means striving to approach the origin of beings, not uniting like the warp and the web, the threads of which, although near, are nevertheless separate from each other. This was related to me by the Imam Arastu [Aristotle], who was a chief of the learned and

> said to me thathe had derived it from an old treatise upon logic, the precepts of which were without explanation, and to have bestowed on itthat arrangement under which it now exists among the learned: he meant, probably, that the maxims are the same as those ex-tracted from the Tarka. The same doctrine was taught in Greece; in confirmation of this, the Persians say, that the science of logicwhich was diffused among them was, with other sciences, trans-lated into the language of Yonia and Rumi, by order of king Secander [Alexander], the worshiper of science, in the time of hisconquest, and sent to Rumi.

The similarity in the reasoning of pre-Christian Greece and India wasnoted repeatedly by al-Biruni (1030 CE) in his book on India [9]. The Indiansystem takes the material processes to be governed by laws in the ancientphilosophical framework of S¯am. khya, which takes the evolution and changein the world to be entirely materialistic while acknowledging the existence of consciousness as a separate category.

ARISTOTLE'S LOGIC

In the West, Aristotle's theory of the syllogism has had enormous influence. At one time in Greece, Stoic logic was more influential until Aristotles ideasbecame dominant, and they were subsequently adopted by the Arabic andthe Latin medieval traditions. The commentators grouped Aristotle's workson logic under the title *Organon* (Instrument), which comprised of:

1. Categories
2. On Interpretation
3. Prior Analytics
4. Posterior Analytics
5. Topics
6. On Sophistical Refutations

The central notion in Aristotle's logic is that of deduction involvingpremise of the argument, and the conclusion. It also recognizes induction, which is an argument from the particular to the universal. In Aristotle's syllogism, the primary premise is always universal, and it may be positive or negative. The secondary premise may also be universal or particular so that from these premises it is possible to deduce a valid conclusion. An example is : "All men are mortal; Socrates is a man; therefore, Socrates is mortal." Another:

- Everything that lives, moves (primary premise)
- No mountain moves (secondary premise)
- No mountain lives (conclusion)

Aristotle supposed that this scheme accurately represents the true natureof thought. If we take thought, language, and reality to be isomorphic, consideration of our reasoning will help us understand reality.

In *Categories*, Aristotle makes a distinction among three ways in which the meaning of different uses of a predicate may be related to each other: *homonymy, synonymy, and paronymy* ("equivocal," "univocal," and "derivative"). For any such use, he proposed descriptions in ten attributes: substance, quantity, quality, relative, where, when, being in a position, having, acting on, and being affected by. The most important of these is substance, which is the individual thing itself; secondary substances include the species and genera to which the individual thing belongs. The other categories distinguish this individual substance from others of the same kind.

In *Interpretation*, Aristotle considers the use of predicates in combination with subjects to form propositions or assertions, each of which is either trueor false. But he recognizes that certain difficulties arise when speaking of the future. He suggests that it is necessary that either tomorrow's event willoccur or it will not, but it is neither necessary that it will occur nor necessarythat it will not occur.

In *Prior Analytics*, Aristotle used mathematics as a model to show that knowledge must be derived from what is already known. The process of reasoning by syllogism formalizes the the deduction of new truths from es-tablished principles. He offered a distinction between the non-living andthe living in terms of things that move only when moved by something elseand those that are capable of moving themselves. He also distinguished be-tween the basic material and the form and purpose which jointly define theindividual thing.

He suggested four different explanatory principles or causes in his *Physics*: (i) the *material cause* is the basic substance out of which the thing is made (like the building materials for a house); (ii) *the formal cause* is the pattern in conformity with which these materials are assembled (like the builder'splan of the house); (iii) *the efficient cause* is the agent or force immediately responsible for the production of the thing (builders of the house); and (iv) *the final cause* is the end purpose for which a thing exists (shelter to the resident of the house). Aristotle believed that the four causes are essential in the existence and nature of all things.

The four causes apply clearly to machines built by man. As for things that appear to arise by pure chance, Aristotle believed that there must likewise be four causes of which we may not be unaware.

Aristotle's logic has been the basis of theology in the West. Modern science rejects the notion of final causes. Creationism and theories of Intelligent Design are an attempt to bring in final causes into biology.

THE INDIAN TRADITION

Logic (*anvīkṣikī, nyāya*, or *tarka* in Sanskrit) is one of the six classical schoolsof Indian philosophy. These six schools are the different complementary per-spectives on reality,

that may be visualized as the views from the windows inthe six walls of a cube within which the subject is enclosed. The base is the system of the traditional rites and ceremonies (Pūrva Mimamsa), and the ceiling is reality that includes the objective world and the subject (Uttara Mimamsa or Vedānta); one side is analysis of linguistic particles (Nyāya),with the opposite side being the analysis of material particles (Vaiśeṣika); another side is enumerative categories in evolution at the cosmic and individual levels (Sāṅkhya), with the opposite side representing the synthesisof the material and cognitive systems in the experiencing individual (Yoga). Clearly, the use of systematic view of nature had been taken to a very advanced level. Logic is described in Kauṭilya's Arthaśāstra (c. 350 BCE) as an independent field of inquiry ānvīkṣikī [10]. The epic Mahābhārata, which is mostlikely prior to 500 BCE because it is not aware of Buddhism in its long descriptions of religion [11], declares (Mahābhārata 12.173.45) that ānvvīkṣikī is equivalent to the discipline of tarka. Clearly, there were several equivalentterms in use in India for logic in 500 BCE.

The canonical text on the Nyāya is the Nyāya Sūtra of Akṣapāda Gautama. The most important early commentary on this text is the Nyāya Bhāṣya of Vātsyāyana which is estimated to belong to 5th century CE. Satisa Chandra Vidyabhusana, the well-regarded authority on Indian logic, assigned Akṣapāda Gautama the date of approximately 550 BCE. He based this onthe reference in the Kāṇva recension of the Śatapatha Brāhmaṇa, in which Gautama (or Gotama) is shown to be contemporary of Jātukarṇya Vyāsa, who was a student of Āsurāyaṇa. This and other evidence from the Gṛhya Sūtras, the Vāyu Purāṇa, and the Buddhist Sanskrit text the Divyāvadāna is summarized in the introduction of Vidyabhusana's edition of the Nyāya Sūtra [12].

In his "History of Indian Logic", Vidyabhusana modified his views [13] under the influence of the then current ideas of history of science and the now-discredited Aryan invasion theory. He now argued that the texts speak of two Gautamas who are both associated with logic. He declared that Medhātithi Gautama (was) the founder of ānvīkṣikī (circ 550 BCE), and Akṣapāda Gautama came much later, perhaps 150 CE or so.

Indian science and chronology has come in for a major revision in recent years. Archaeologists have found no evidence for any large migration intoIndia subsequent to 4500 BCE, and found that Indian art, iconography, socialorganization, and cultural motifs can be traced to a tradition that beganin 7000 BCE [14-17]. There is also new textual analysis that pushes backthe origins of Indian astronomy and mathematics considerably [18-21]. We see Indian scientific ideas develop in a systematic manner over a period of several centuries going back to the second millennium BCE, if not earlier [22-29]. This development is an enlargement in different fields of the recursivesystem of Vedic cosmology [5]. We also know that ancient India and WestAsia had considerable interaction much before the time of Alexander [30].

Parenthetically, we note that genetic evidence related to mitochondrial DNA and the Y chromosome has allowed the reconstruction of the movements of ancient peoples.

According to the highly regarded synthesis of thisevidence by Stephen Oppenheimer [31], India was populated by people wholeft Africa about 90,000 years ago, and that in India over the next tens of thousands of years, both the Mongoloid and the Caucasoid types evolved, migrating to the northeast and northwest regions about 50,000 years ago.

The earlier chronology of Indian texts was coloured first by the then popular Biblical chronology that took the origin of mankind to go back to only 4004 BCE, and later by the theory of Aryan invasions for which archaeol-ogists have found no support [15-17]. According to Stephen Oppenheimer, genetic evidence also goes counter to the Aryan invasion theory. One must, therefore, question Vidyabhusana's revision of the chronology of Indian logic, especially in light of the new understanding of the literary tradition and theevidence related to the presence of Indian kingdoms in West Asia in thesecond millennium BCE that provides a late material basis for the culturalcontinuity between India and the West.

GAUTAMA'S NYĀYA SUTRA

The Nyāya also calls itself *pramāṇa śāstra*, or the science of correct knowledge. Knowing is based on four conditions: (i) The subject or the *pramaṭṛ*; (ii) The object or the *prameya* to which the process of cognition is directed; (iii) The cognition or the *pramiti*; and (iv) the nature of knowledge, or the *pramāṇa*. The four pramāṇas through which correct knowledge is acquired are: *pratyakṣa* or direct perception, *anumāna* or inference, *upamāna* or analogy, and *śabda* or verbal testimony.

The function of definition in the Nyāya is to state essential nature (*svarūpa*) that distinguishes the object from others. Three fallacies of definition are described: *ativyāpti*, or the definition being too broad as in defining a cow as a horned animal; *avyāpti*, or too narrow; and *asambhava*, or impossible.

Gautama mentions that four factors are involved in direct perception: the senses (*indriyas*), their objects (*artha*), the contact of the senses and the objects (*sannikarṣa*), and the cognition produced by this contact (*jñāna*). The five sense organs, eye, ear, nose, tongue, and skin have the five elements light, ākāśa, earth, water, and air as their field, with corresponding qualitiesof color, sound, smell, taste and touch.

Manas or mind mediates between the self and the senses. When themanas is in contact with one sense-organ, it cannot be so with another. Itis therefore said to be atomic in dimension. It is due to the nature of themind that our experiences are essentially linear, although quick succession of impressions may give the appearance of simultaneity.

Objects have qualities which do not have existence of their own. Thecolor and class associated with an object are secondary to the substance. According to Gautama, direct perception is inexpressible. Things are notperceived as bearing a name. The conception of an object on hearing a nameis not direct perception but verbal cognition.

Not all perceptions are valid. Normal perception is subject to the existence of (i) the object of perception, (ii) the external medium such as lightin the case of seeing, (iii) the sense-organ, (iv) the mind, without which the sense-organs cannot come in conjunction with their

objects, and (v) the Self. If any of these should function improperly, the perception would beerroneous. The causes of illusion may be *doṣa* (defect in the sense-organ), *samprayoga* (presentation of only part of an object), or *saṃskāra* (habit basedon irrelevant recollection).

Anumāna (inference) is knowledge from the perceived about the unperceived. The relation between the two may be of three kinds: the element to be inferred may be the cause or the effect of the element perceived, or the two may be the joint effects of something else. The Nyāya syllogism is expressed in five parts:

1. *pratijñā*, or the proposition: the house is on fire;
2. *hetu*, or the reason: the smoke;
3. *dṛṣṭānta,* the example: fire is accompanied by smoke, as in the kitchen;
4. *upanaya*, the application: as in kitchen so for the house;
5. *nigamana*, the conclusion: therefore, the house is on fire.

This recognizes that the inference derives from the knowledge of the universal relation (*vyāpti*) and its application to the specific case (*pakṣadharmatā*). There can be no inference unless there is expectation (*ākāṅkṣā*) about the hypothesis which is expressed in terms of the proposition.

The minor premise (*pakṣadharmatā*) is a consequence of perception, whereas the major premise (*vyāpti*) results from induction. But the universal proposition cannot be arrived at by reasoning alone. Frequency of the observation increases the probability of the universal, but does not make it certain. Gangeśa, a later logician, suggested that the apprehension of the universal requires *alaukika pratyakṣa* (or nonsensory apprehension).

The Nyāya system lays stress on antecedence in its view of causality. Butboth cause and effect are viewed as passing events. Cause has no meaningapart from change; when analyzed, it leads to a chain that continues withoutend. Causality is useful within the limits of experience, but it cannot beregarded as of absolute validity. Causality is only a form of experience.

The advancement of knowledge is from *upamāna*, or comparison, with something else already well-known. The leads us back to induction through *alaukika pratyakṣa* as the basis of the understanding.

Śabda, or verbal testimony, is a chief source of knowledge. The meaning of words is by convention. The word might mean an individual, a form, ora type, or all three. A sentence, as a collection of words, is cognized from the trace (*saṃskāra*) left at the end of the sentence. Knowledge is divided into cognitions which are not reproductions of former states of consciousness (*anubhava*) and those which are recollections (*smṛti*). The Nyāya speaks of errors and fallacies arising by interfering with theprocess of correct reasoning. The Nyāya attacks the Buddhist idea that no knowledge is certain by pointing out that this statement itself contradicts the claim by its certainty. Whether cognitions apply to reality must be checked by determining if they lead to successful action. *Pramā*, or valid knowledge, leads to successful action unlike erroneous knowledge (*viparyāya*).

MORE ON GAUTAMA'S LOGIC AND PHYSICS

Gautama's propositions assume a dichotomy between object and subject. The objective world is open to logical analysis since it maps to linguisticcategories; the subjective world can suffer from invalid perception for a va-riety of reasons. This is consistent with the Vedic view that the althoughthe inner world maps the outer, the mind can be clouded by habits or wrongdeductions owing to incorrect assumptions.

The Sāṅkhya, attributed to the legendary rishi Kapila, is the first philosophy of science that arose centuries before the Buddha and it is the background to be considered when speaking of Indian logic. In Sāṅkhya, evolution occurs due to changing balance and proportion both in the objective and the subjective worlds. The three *guṇas* or fundamental modalities are *sattva, tamas* and *rajas*, and they operate both at the large scale as well as in local transformation. The normative "thing" behind this ceaseless change is the witness, or Self, who is viewed in the singular for the entire universe.

At the objective level, *tamas* is inertia, *rajas* is action or transformation and *sattva* is the relative balance or equilibrium between *tamas* and *rajas,* which is obtained through self-knowledge. The interplay between the three sets up oscillations in the objective and the mental levels. In Yoga, the objective is to achieve the cessation of the fluctuations of the mind.

Consciousness or pure awareness is by definition not an object and therefore it does not have attributes. It must for the same reason be beyond the categories of the living or dead. It must be beyond inertia, or change or fluctuations. It is extraordinary that in this analysis the qualities that are associated with objects become describable by an internal order.

The *guṇas* do not admit of any further breakdown. This defines a position that is deeper and different from that of Aristotelian physics. The three *guṇas* are present in all objects and we can isolate one only in terms of the momentary strength of one in relation to the other in a process. Their fluctuations mark the universal "internal clock" of worldly processes.

In the Sāṅkhya, the effect is the cause in a new form, and this is why the system is also called *pariṇāmavāda*, or theory of transformation. Between the cause and effect is a relation of identity-and-difference, that is identity of stuff but difference of form (*bhedābheda*). The method at the basis of the Sāṅkhya and the Nyāya Sūtra may be seen in the Yoga Sūtra as well. In Yoga Sūtra 3.13 three aspects of change are identified: transformation of a thing (*dharmi*) into a property (*dharma*), transformation of a property into a mark (*lakṣaṇa*), and the transformation of a mark into a condition (*avasthā*). This is then the basis of the "unreasonable effectiveness" of mathematics in the description of the world.

THE FORM OF THE NYĀYA SYLLOGISM

The five parts of the Nyāya syllogism spring from the idea of *bandhu* that is fundamental to Vedic thought. The *bandhu* is the equivalence between two different systems, which ordinarily are the microworld, the macroworld, and the individual's cognitive system.

The Nyāya syllogism first sets up the propositional system with its two components

(*two parts*) and then identifies another well known system to which the first is supposed to have a *bandhu*-like relationship (*third and fourth parts*). The conclusion (*fifth part*) can be made only after the preliminarieshave been formally defined. As we see, this takes five steps.

The appeal to the *bandhu* in the syllogism is to acknowledge the agency of the subject who can be, without such knowledge, open to invalid perception. One can see how in systems that do not accept transcendental reality (such as Aristotle's or Buddhist), a simplification from the five-part to the three-part syllogism would be most natural.

It was pointed out in a 1930 article by the French Indologist Rene Guenon [32-33], that some later Indian texts on logic present two abridged forms of the five-membered syllogism of the Nyāya Sūtra, in which either the firstthree or the last three parts appear alone. The first version is similar tothe 6th century Nyāyapraveśa of India (which had much influence on Chinese Buddhism and on Jain thought), and the latter version resembles the syllogism of Aristotle. It appears then that the Nyāya Sūtra syllogism was only the most comrehensive way of establishing the chain of reasoning consistent with Vedic ideas of *bandhu*, and since two different simplifications arose out of it, it islikely to have been the older tradition.

CONCLUDING REMARKS

We find that as *anvīkṣikī* Indian logic goes back to at least the 6th century BCE based on the textual evidence that has been universally accepted. The syllogism used in the Nyāya Sūtra has five parts, as against the three-partsyllogism of Aristotle's logic. But we know that simplification of the five-partlogic into one similar to Aristotle's was also known in India.

It seems that although the Greek and Persian stories related to Kallisthenes having brought Indian logic to Greece may have a historical basis, they are not to be taken as the literal truth. At best, Indian logic provided inspiration in the sense of the need for a formal text on the subject by the Greeks. The focus in the two logical traditions is quite different, and eitherone is unlikely to have borrowed from the other.

Regarding the transmission of the Indian texts, this could have occurred only at the tail-end of Alexander's campaign of conquest. It is quite likely that Aristotle's logical texts were already in place by that time. It is more likely that the Greek and Persian traditions merely acknowledge a different system of logic in a civilization that existed far away. The Nyāya Sūtra and Aristotle's texts are two different perspectives that tie in with the cosmologies of the two civilizations. The Nyāya Sūtra, like other Indian philosophical texts, maintains the centrality of the subject, whereas in Aristotle's logic the emphasis is on the design of the world as a machine. This also corresponds to the difference in the Indian system which considers the universe to be composed of five elements, as against the four of Aristotle. The fifth element (*ākāśa*) of the Indian system concerns the field of sentience.

Diogenes Laertius in his *Lives of the Eminent Philosophers* [34] says this of Democritus: "According to Demetrius in his book on Men of the Same Name and Antisthenes in his Successions of Philosophers, he [Democritus] traveled into Egypt to learn geometry from the priests, and he also went into Persia to visit the Chaldaeans as well as to the Red

Sea. Some say that he associated with the Gymnosophists in India and went to Aethiopia" [page 445]. Judging from the rest of the biographical material in Diogenes' account, a visit to India is not entirely implausible. Diogenes represents Democritus as a "student of the Magi" from boyhood, and an enthusiastic and well funded traveler. This is evidence of the interaction between India and Greece that goes back much before Aristotle. The legend that Indian logic was taken byAlexander to Greece is just the acknowledgement that Indians had a fully flowered system of logic before the time of Aristotle, who himself perhaps only reworked an earlier Greek tradition.

Acknowledgement. I am thankful to Andre Heilper for asking me about the relationship betweenGreek and Indian logic, and to Linda Johnsen for discussion and drawing my attention to the book by Diogenes Laertius.

NOTES

1. "Aristotle collected, arranged, and corrected all that had been discovered before his time, and brought it to an incomparably greater stateof perfection. If we thus observe how the course of Greek culture hadprepared the way for, and led up to the work of Aristotle, we shallbe little inclined to believe the assertion of the Persian author, quotedby Sir William Jones with much approval, that Callisthenes found acomplete system of logic among the Indians, and sent it to his uncle Aristotle" [7].
2. Quoted in the note by Heilper.

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25
Laws of Thought and Indian Logic*

Abstract. This article explores an important problem of history of science, namely the influence of Indian logic on George Boole's *The Laws of Thought*. The theories that have been proposed to explain the origins of his algebra have ignored his wife Mary Boole's claim that he was deeply influenced by Indian logic. This paper investigates this claim and argues that Boole's focus was more than a framework for propositions and that he was trying to mathematize cognitions as is done in Indian logic and to achieve this he believed an algebraic approach was the most reasonable. By exploring parallels between his work and Indian logic, we are able to explain several peculiarities of his algebraic system.

INTRODUCTION

There is continuing interest in the antecedents to George Boole's *The Laws of Thought*[1] and much discussion on how he created a system in which the algebraic and logical calculi are not in perfect accord[2]. The sum and difference operations that Boole denotes by + and − are neither the standard set-theoretical union (between arbitrary sets) nor the set-theoretical difference.

The discrepancy between algebra and logic seen in Boole's system is problematic given that it was a period where these questions were much in discussion and his friend Augustus De Morgan (1806-1871) had also presented a formal framework for logic[3,4]. Boole (1815-1864) was the younger colleague of De Morgan, and the two of them carried on an extensive correspondence for years that was published in 1982[5]. However, this correspondence shows they ignored each other's work suggesting that they were still in the process of developing their ideas and they saw their work as somewhat tentative.

Another interesting perspective related to Boole's work is provided by his wife Mary Boole (1832-1916), who, during her times, was a well-known writer on mathematical subjects. She claims[6] that her husband as well as De Morgan and Charles Babbage were influenced deeply by Indian logic and her uncle George Everest (1790-1866), who lived for a long time in India and whose name was eventually given to the world's highest peak, was the intermediary of these ideas. She says[6]: "Think what must have been the effect of the intense Hinduizing of three such men as Babbage, De Morgan, and George Boole on the mathematical atmosphere of 1830–65," further speculating that these ideas also influenced the development of vector analysis and modern mathematics. Although this statement of Mary Boole is well known, I know of no scholarly study that has attempted to explore the question of the Influence of Indian logic on Boole's work.

Let's follow the line of thought that arises from Mary Boole's claim. An account of

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Indian logic was presented by the Sanskritist H.T. Colebrooke at a public meeting of the Royal Asiatic Society 1824 and widely discussed in the scholarly world. Robert Blakely had a chapter on "Eastern and Indian Logic" in his 1851 book titled *Historical Sketch of Logic* in which he suggested that this knowledge has "been brought prominently forward among European *literati*"[7]. De Morgan admitted to the significance of Indian logic in his book published in 1860: "The two races which have founded the mathematics, those of the Sanscrit and Greek languages, have been the two which have independently formed systems of logic"[8]. One must therefore accept the correctness of Mary Boole's statement that De Morgan, George Boole and Babbage were cognizant of Indian logic even though George Boole does not mention Indian logic texts or the larger tradition in his book. We must ascribe this to the fact that while per Mary Boole's claim, George Boole and others knew of Indian logic, they were apparently not knowledgeable of its details since only a few of the Sanskrit logic texts had by then been translated into English.

This paper examines the question of Indian influence and tries to estimate what aspects of Indian logic are likely to have played a role in the ideas of George Boole. Although scholars are agreed that Indian logic had reached full elaboration, it was expressed in a special technical language that is not easily converted into the modern symbolic form. One can assume that Boole most definitely was aware of the general scope of Indian logic and knew that its focus was the cognition underlying the logical operation and this is something he aimed in his own work. He was trying to mathematize the role of the cognition and he believed that algebra would be effective for this purpose. To the extent he was attempting to go beyond what he knew of Indian logic, he thought he could do so by using mathematics.

BOOLE'S ALGEBRA

Boole's starting point was algebra with variables like x and y, and algebraic operations such as addition and multiplication. He wished to show that algebra had in it the potential to extend the applicability of logic as well as the capacity to handle an arbitrary number of propositions. This is how he put it in his *Laws of Thought*[1]:

> There is not only a close analogy between the operations of the mind in general reasoning and its operations in the particular science of Algebra, but there is to a considerable extent an exact agreement in the laws by which the two classes of operations are conducted. Of course the laws must in both cases be determined independently; any formal agreement between them can only be established a posteriori by actual comparison. To borrow the notation of the science of Number, and then assume that in its new application the laws by which its use is governed will remain unchanged, would be mere hypothesis. There exist, indeed, certain general principles founded in the very nature of language, by which the use of symbols, which are but the elements of scientific language, is determined. [Section 6 of Chapter 1]

Boole's algebra is about classes. He says: "That the business of Logic is with the

relations of classes, and with the modes in which the mind contemplates those relations."[9] He represents the universe of conceivable objects by 1 or unity. Given the objects which are Xs, he calls the class by the same symbol X, and he means by the variable x "an elective symbol, which represents the *mental operation of selecting* [my emphasis] from that group all the Xs which it contains, or of fixing the attention upon the Xs to the exclusion of all which are not Xs"[9].

In my view, this emphasis on the "mental operation of selection" is the key to his scheme for it enlarges the setting to a much bigger system than the "universe of discourse" (a concept generally attributed to De Morgan but used as a phrase for the first time in *The Laws of Thought*).

Given two classes X and Y, Boole wrote:

x = the class X,

y = the class Y,

xy = the class each member of which is both X and Y, and so on.

Since selecting objects from the same class leaves the class unchanged, one can write:

$$xx = x^2 = x$$

In like manner he took

$1 - x$ = the class not-X (1)

$1 - y$ = the class not-Y (2)

$x(1 - y)$ = the class whose members are Xs but not-Ys (3)

$(1 - x)(1 - y)$ = the class whose members are neither Xs nor Ys (4)

Furthermore, from consideration of the nature of the mental operation involved, he showed that the following laws are satisfied:

$$x(y + z) = xy + xz \quad (5)$$

$$xy = yx \quad (6)$$

$$x^n = x \quad (7)$$

From the first of these it is seen that elective symbols are distributive in their operation; from the second that they are commutative. The third he termed the *index law*, the heart of his system, which he believed deals with the election (or choice) that constitutes the process of logical inference.

He concluded: "The truth of these laws does not at all depend upon the nature, or the number, or the mutual relations, of the individuals included in the different classes. There

may be but one individual in a class, or there may be a thousand. There may be individuals common to different classes, or the classes may be mutually exclusive. All elective symbols are distributive, and commutative, and all elective symbols satisfy the law expressed by (7)."[9]

Given n classes x, y, z, … the universe can be partitioned into 2^n regions where the classes come together in different ways.

With a single class, you have only two sets the class X and its complement, the class "not X" which was represented by Boole as (1-x).

$$1 = x + (1 - x) \tag{8}$$

For two classes, X and Y, we have the situation in equation (9) or, equivalently, in Figure 1:

$$1 = xy + x(1 - y) + (1 - x)y + (1 - x)(1 - y) \tag{9}$$

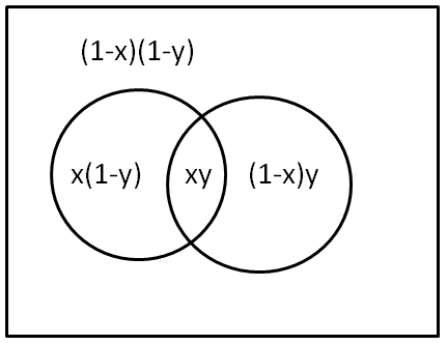

Figure 1. Four exclusive sets generated by classes X and Y (eqn. 9)

For three classes, X,Y, and Z, the situation is given by equation (10):

$$1 = xyz + xy(1 - z) + x(1 - y)z + (1 - x)yz + x(1 - y)(1 - z) + (1 - x)y(1 - z) + (1 - x)(1 - y)z + (1 - x)(1 - y)(1 - x) \tag{10}$$

This is shown in Figure 2 below, where the region 1 is xyz; region 2 is xy(1-z) and so on.

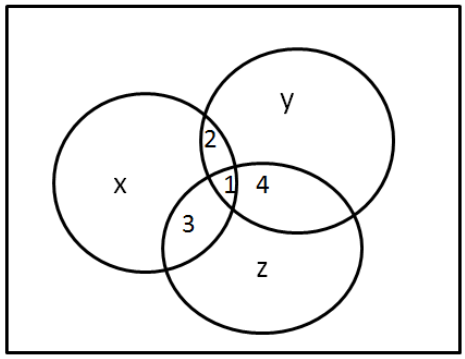

Figure 2. Division of the universe into 3 classes

Boole's system does not constitute what we know now as Boolean algebra, being different in fundamental ways. Boole's algebra X+Y cannot be interpreted by set union because $(X+Y)^2$ is not equal to (X+Y) as required by the condition (7):

$$(x+y)^2 = x^2 + y^2 + 2xy = x + y + 2xy$$

This is equal to (x+y) only under the restrictive condition that x and y are mutually exclusive.

Likewise, (x-y) is not a proper set since

$$(x-y)^2 = x^2 + y^2 - 2xy = x + y - 2xy$$

This is equal to (x-y) only under the condition that y is a subset of x, or xy =y. These two restrictive conditions are not consistent so Boole's algebra cannot be used in an effective manner for classes except to define subclasses as in (8) though (10).

What we now know as Boolean algebra is different from Boole's algebra, and why it works to the extent it does including division by 0 is now well understood[10]; Boolean algebra as we know was developed by Boole's successors[11,12].

Boole speaks to the deeper foundations of logic in the concluding chapter of *The Laws of Thought*:

> [A]n evidence that the particular principle or formula in question is founded upon some general law or laws of the mind, and an illustration of the doctrine that the perception of such general truths is not derived from an induction from many instances, but is involved in the clear apprehension of a single instance. .. As in the pure abstractions of Geometry, so in the domain of Logic it is seen, that the empire of Truth is, in a certain sense, larger than that of Imagination. And as there are many special departments of knowledge which can only be completely surveyed from an external point, so the theory of the intellectual processes, as applied only to finite objects, seems to involve the recognition of a sphere of thought from which all limits

are withdrawn.[1]

By this he means that a study of logic is likely to bring one closer to the domain of the mind that is informed by a deeper "infinite" truth. This is where intuitions of number and consequently of algebra were to be the bedrock of higher structures. This is why he was willing to use variables that were not immediately meaningful, for he believed they had the capacity to go beyond standard syllogisms.

INDIAN LOGIC: NYĀYA AND NAVYA NYĀYA

Let's now talk briefly of Indian logic (Nyāya), which has a long history[13,14] that goes back to about 500 BCE. The stated goal in Nyāya is to describe essential nature (*svarūpa*) that distinguishes the object from others. The fallacies of definition are that it is too broad, too narrow, or just impossible. There is also an old tradition that Greek and Indian logics are related[15] and Kallisthenes, who was in Alexander's party, took logic texts from India and the beginning of the Greek tradition of logic must be seen in this material, but this is an issue that doesn't concern us here.

In Indian logic, minds are not empty slates; the very constitution of the mind provides some knowledge of the nature of the world. The four pramāṇas through which correct knowledge is acquired are perception (*pratyakṣa*), inference (*anumāna*), analogy (*upamāna*), and testimony (*śabda*).

Navya-Nyāya is a medieval elaboration of Indian logic[16,17]. It was founded by Udayana (c. 1050 CE), and further developed by Gaṅgeśa (c. 1200 CE), reaching its culmination in the works of Raghunātha (c. 1500 CE), Jagadīśa (c. 1600 CE) and Gadādhara (c. 1650 CE). The school developed a highly technical language. Its most famous text is Gaṅgeśa's *Tattvacintāmaṇi* ("Thought-Jewel of Reality") that deals with questions that cover logic, set theory, and epistemology.

Navya-Nyāya is concerned with describing the cognition of concern to the logician and its expression in language[18]. The cognition is supposed to be based on three facts: (i) two acts cannot be simultaneous; (ii) if introspection is to be possible, then the introspective act must follow immediately upon the object act, and that is must not be more than one jump behind; (iii) the succeeding act constantly chases the preceding act. In other words, there is an attempt to analyze the very act of logical analysis.

The Nyāya technical language is not as elegant as a pure symbolic language and to process its claims is tedious[19,20]. In principle, this language can be converted into symbolic form. The syntax of the language consists of relational abstract expressions, different kinds of term expressions —primitive, relational, abstract, and negative— and a negation particle.

A property with an empty domain was taken to be fictitious or unreal and non-negatable. Negation was considered a valid operation only on real properties. This could be considered to generate a three-valued table. If P, N, and U represent "positive", "negative", and "unnegatable", then we have the truth table[21]:

w	not-w
P	N
N	P
U	U

Knowledge was taken to be analyzed into three kinds of epistemological entities in their interrelations: "qualifier" (*prakāra*); "qualificand", or that which must be qualified (*viśeṣya*); and "relatedness" (*saṃsarga*). For each of these there was a corresponding abstract entity. Various relations were introduced, such as direct and indirect temporal relations, *paryāpti* relation (in which a property resides in sets rather than in individual members of those sets), *svarūpa* relation (which holds, for example, between an absence and its locus), and relation between the cognition of a knowledge and its object.

The concept of "limiterness" was used to put limits on time, property, and relations. The notion of negation was developed beyond specifying it with references to its limiting counterpositive limiting relation, and limiting locus. The power of the technical language becomes clear when it is noted that questions such as the following were asked: Is one to recognize, as a significant negation, the absence of a thing A so that the limiter of the counterpositive A is not A-ness but B-ness? Gaṅgeśa said that the answer to these three questions was in the negative but he thought that the absence of an absence itself could lead to a new property suggesting consideration of higher abstractions.

According to Chakrabarti[19], Navya Nyāya anticipated several aspects of modern set theory. He explains:

> Udayana says that there can be no universal of which every universal is a member; for if we had any such universal, then, by hypothesis, we have got a given totality of all universals that exist and all of them belong to this big universal. But this universal is itself a universal and hence (since it cannot be a member of itself, because in Udayana's view no universal can be a member of itself) this universal too along with other universals must belong to a bigger universal and so on ad infinitum. What Udayana says here has interesting analogues in modern set theory in which it is held that a set of all sets (i.e., a set to which every set belongs) does not exist.

An overall summary is provided by Staal[22], "The representation of logical structures by means of Sanskrit expressions in Indian logic constitutes a formalization which is similar to the formalization adopted by Western symbolic logic. The various technical terms, the formation of compounds, the morphological means of expression (e.g. suffixes and case endings) and the syntactical means of expression (e.g. appositional clauses) in the technical Sanskrit of Navya-Nyāya are analogous to the terms, the formulas and the rules of modern Western logic."

In passing, we must add that Nyāya complements other approaches to reality through consideration of physical entities and the interaction of the observer and the observed[23,24,25], that have much affinity with quantum logics[26,27]. In the Indian physics tradition of Vaiśeṣika, the interaction between matter and mind was viewed through the idea of samavāya[28], which opens up several points of conceptual overlap with post-classical conceptions of reality[23,29]. This is relevant because of Boole's claim quoted earlier in which he expresses the belief that intellectual processes constitute a "sphere of thought from which all limits are withdrawn." This willingness to confront "infinity" shows up in the details of Boole's algebra as described next.

BOOLE'S INTERPRETATION PROCEDURE

Boole considered his algebraic methods for doing logic to be sound so long as he could interpret the end formula correctly. However, the expressions in the derivation had terms that could not have the usual meaning associated with the variables. For example, what does the equation xw = y mean about the class w? Boole solves this equation for w, obtaining w=y/x, and then expands it out.

In order to show how it was done, he took the algebraic function f(x) to be given by what he called the Expansion Theorem[30]:

$$f(x) = f(1)\, x + f(0)\, (1-x) \tag{11}$$

He claimed this was an identity by taking f(x) = a x + b (1-x), where a and b can be computed by putting x=0 and x=1, respectively by what he called the Elimination Theorem[31]. Using x' as abbreviation for (1-x), he now wrote

$$f(x,y) = f(1,1)\, xy + f(1,0)\, xy' + f(0,1)\, x'y + f(0,0)\, x'y' \tag{12}$$

Thus if f(x,y) = y/x, he wrote this out without worrying about division by zero:

$$y/x = 1.\, xy + 0.\, xy' + 0/0\; x\; y + 1/0\; x'y \tag{13}$$

The term 0/0 contributes an indeterminate component to y/x as shown for v can be any subset of x'y' and the 1/0 term is to be solved separately by the side-condition that x'y = 0.

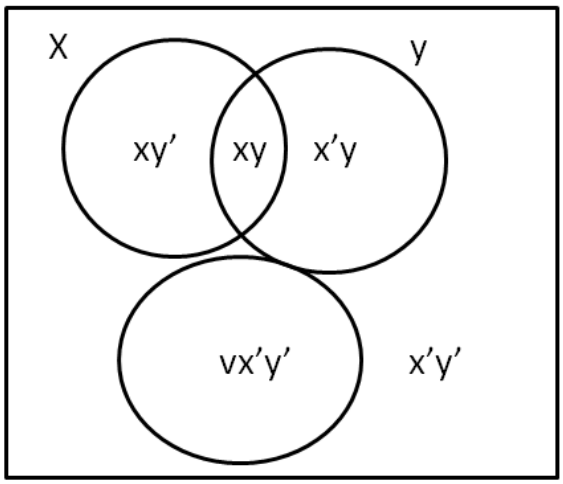

Figure 3. Division of the universe into 3 classes, where v is indeterminate

This keeps open the possibility that there are unknown other sets that can be part of the inference. The fact that an additional set outside of x and y can be associated with the problem must have been a point of attraction to Boole, although we know now that it does not provide any benefits and muddles up the analysis.

Perhaps the logic of going beyond x and y and consideration of the indeterminate component paralleled the idea of catuṣkoṭi, which has long been part of Indian logic. It has four components: P stands for any proposition and Not-P stands for its complement; both P and Not-P represents the usual universe; but the fourth part here is neither P nor Not-P. The fourth part represents going beyond the domain of P and Not-P.

DISCUSSION

This article suggests explanations for George Boole's development of his algebra for logic and the origins of its inadequacies. We have suggested parallels between his ideas and certain aspects of Indian logic that support his wife Mary Boole's assertion that he was deeply influenced by it. We argue that Boole's focus was more than a framework for propositions and that he was trying to mathematize cognitions in the tradition of Indian logic and this is consistent with his own assertion that laws of thought should not be constrained by finitude. This may explain why he was happy to use operations in his algebra that allowed division by zero, which required further side-rules to eliminate infinities so that the final results were correct.

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PART 5

REALITY AND ART

26
Early Indian Architecture and Art*

Abstract: This article deals with architecture, temple design, and art in ancient India and also with continuity between Harappan and historical art and writing. It fills in the gap in the post-Harappan, pre-Buddhist art of India by calling attention to the structures of northwest India (c. 2000 BCE) that are reminiscent of Late-Vedic themes, and by showing that there is preponderant evidence in support of the identity of the Harappan and the Vedic periods. Vedic ideas of sacred geometry and their transformation into the classical Hindu temple form are described. It is shown that the analysis of the "Vedic house" by Coomaraswamy and Renou, which has guided generations of Indologists and art historians, is incorrect. This structure that was taken by them to be the typical Vedic house actually deals with the temporary shed that is established in the courtyard of the house in connection with householder's ritual. The temple form and its iconography are shown as natural expansion of Vedic ideology related to recursion, change and equivalence. The centrality of recursion in Indian art is discussed.

INTRODUCTION

Two noteworthy attempts to synthesize ideas about early Indian architecture, which have exercised great scholarly influence, are Ananda Coomaraswamy's essays on the subject that appeared in 1930 and 1931 in the annual journal *Eastern Art* and Louis Renou's article called "La maison védique" (*The Vedic house*) that appeared in *Journal Asiatique* in 1939.[1] Coomaraswamy's essays provided a textual connections for architectural forms and iconography of the period starting with the Mauryas, and Renou used the descriptions of the constructions accompanying Vedic ritual to visualize the form of the house in an earlier period.

Both Coomaraswamy and Renou start with the assumption that the beginnings of Indian architecture are to be traced to the early Sūtra texts that speak of primitive structures. For Coomaraswamy, the Jātakas and the Epics provide textual evidence of the plans of cities and city-gates, palaces, and huts and temples, but glosses over the contradiction in his starting point when he acknowledges that while "the Vedas make occasional reference to the 'cities of the Dasyus,' it is to be observed that in the Brahmanical law books, which are very nearly, if not quite contemporary with the architectural period to be discussed below, cities are despised, and there are no ceremonies for urban life; the *Baudhāyana Dharma Sūtra*, II.3.6.33, says 'It is impossible for one to obtain salvation, who lives in a town covered with dust.'"[2]

The assumption is that the Sūtra texts belong to the period of the Dasyu cities, but these cities are outside the Vedic culture. If the Dasyus are themselves an Indo-Iranian people

* Migration & Diffusion, Vol.6, Nr.23, 6-27, 2005

who show up as "dahyu" in the Iranian literature, the opposition between the Vedic people and the Dasyus is a conflict between groups with kinship relations. On the other hand, the first millennium, pre-Buddhist period of the early Mahābhārata with its description of cities does not have any account of inimical Dasyu kings. The only way to reconcile this seemingly contradictory situation is to suppose that the Vedic ritual texts describe events from the perspective of the priest families committed to an ideology of simplicity and renunciation, which is an ideology that continued in subsequent times. The Vedic world was like the age that followed, with its own complexity revealed in texts that do not deal with ritual.

Renou was acutely aware of the limitations of his study. He concluded his essay by remarking,[3] "If we rely on Vedic texts, we are in the presence of a type of a house that is extremely rudimentary, composed of an armature of posts, connected at the summit by transverse beams onto which a thatched covering is attached. The walls are woven mats. Neither stone nor brick is used." But acknowledging that bricks were an essential part of the Vedic ritual as in the building of the *Agnicayana* fire altar, he was forced to express doubt at his own conclusions by adding, "Nothing obliges us to consider that the shelters described above were the normal type of private residence; a significant amount of the details that assist us in their reconstruction are provided by descriptions of ritual "huts," the intended use of which is entirely different. And yet no other process of construction is mentioned in these sources. This appears particularly singular today, when we are able to measure [through recently discovered archaeological sources] the degree to which architectural technologies were known to certain prehistoric civilizations of northwest of India."

Renou's sources from the sūtra literature described temporary structures that were part of the ritual and, therefore, he had erred in taking that to represent the normal residence. The error is made particularly clear in Atharvaveda 9.3 where several verses speak of dismantling the rather flimsy structure, of which ritual we know from other sources (Kauśikasūtra) as well. Constituting a practice that continues to this day, the ritual-house is given to the priest who had officiated at the rite as part of his fee. To take this structure as an example of the typical residence is an obvious mistake, especially since such an interpretation is at variance with other evidence from the texts regarding the size and scale of the house that will be recounted shortly.

Renou also failed to address properly the question of why would a people not use bricks in their residence when the same bricks were a very important part of their lives in their ritual. This is especially strange given that this ritual is assigned a time when use of brick houses was very common in this geographical area.

SACRED GEOMETRY IN THE HARAPPAN PERIOD

Important new evidence has emerged in the period since the Coomaraswamy and Renou essays were written that demands revisiting both the early historic period and the Vedic period for their architecture. In particular, we have evidence of archaeological forms from the Harappan period that appear to be according to Vedic norms. A significant building has been found in Mohenjo-Daro (Figure 1i) that has a central courtyard and a symmetric arrangement

of rooms.[4] Every other room has a low brick platform that was apparently used for ritual. It also appears that a fire altar was placed in the courtyard. More evidence regarding fire altars comes from Lothal (Figure 1ii). Both these cases represent apparent Vedic ritual in an urban setting.

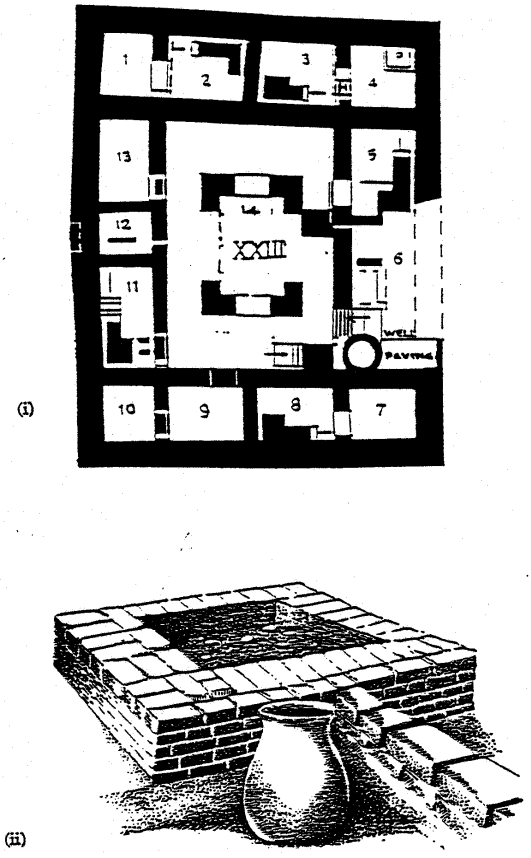

Figure 1. (i) Fire temple from Mohenjo-Daro; (ii) Fire-altar from Lothal

This evidence may however not be considered conclusive regarding its relationship with the ritual described in the Sūtra texts. But our objective is not to furnish proof for such a relationship; it is only to demonstrate that continuity exists between the Harappan culture and the period of the Sūtra texts. As they claim themselves, the authors of these texts were aware of cities.

There is additional evidence from the palace in Dashli-3 in North Afghanistan of 2000 BCE (Figures 2 and 3) that uses yantric forms that have traditionally been considered to be late.[5] Since these forms are obviously in the Vedic tradition (although they would be correctly called post-Vedic), it is clear that palace building was a part of the tradition as early as 2000 BCE, if not earlier.

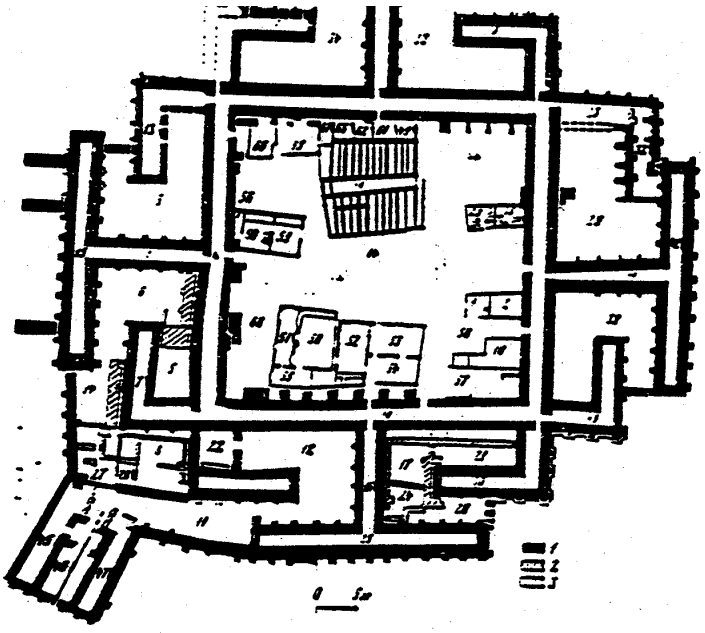

Figure 2. The yantric palace at Dashli-3 in North Afghanistan, 2000 BCE

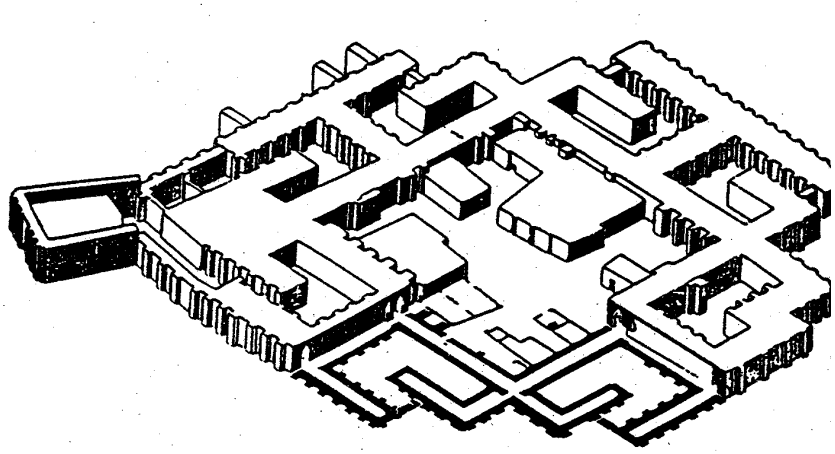

Figure 3. Another view of the Dashli-3 palace

If one were to claim that these structures are the footprints of the immigrating Vedic people into India, one is confronted by the paradox that whereas the Vedic people knew palaces and presumably cities on their way to India, they have no memory of it when they actually arrive there. Since this is impossible, one is left with the alternative that these represent the culture of the Vedic people at a later period in their history.

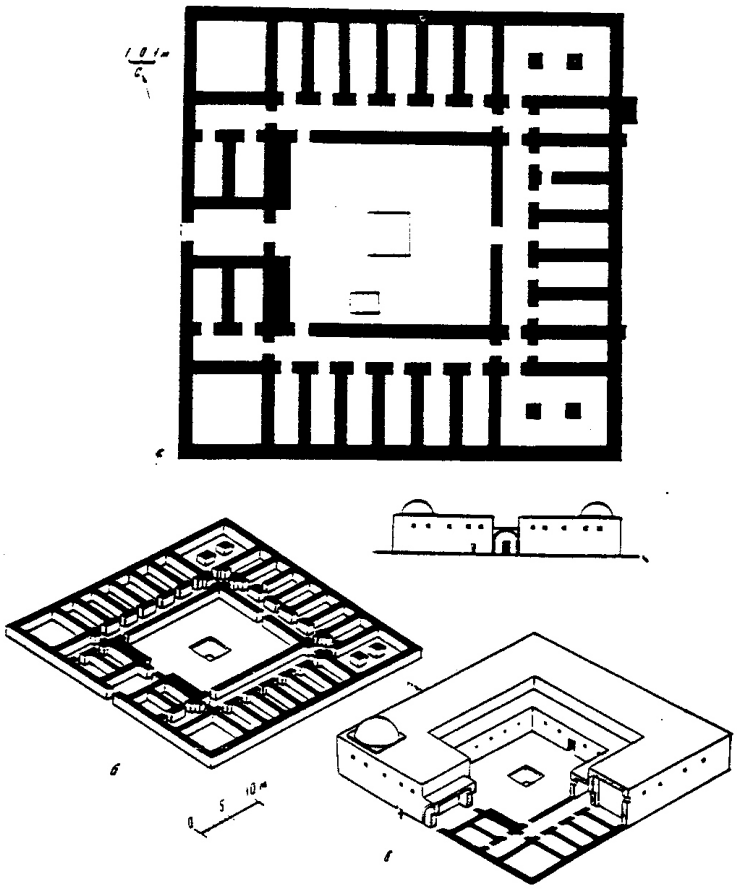

Figure 4. Building plan at Kutlug Tepe, Bactria c 1st millennium BCE

Figure 4 presents the building plan of a palace in Bactria dated to 1st millennium BCE. Its open central courtyard and the altar in the middle are remarkably similar to the plan for sacred and royal structure as provided in the Vāstu texts as shown in Figure 5, confirming continuity with older ideas separated in time and space.

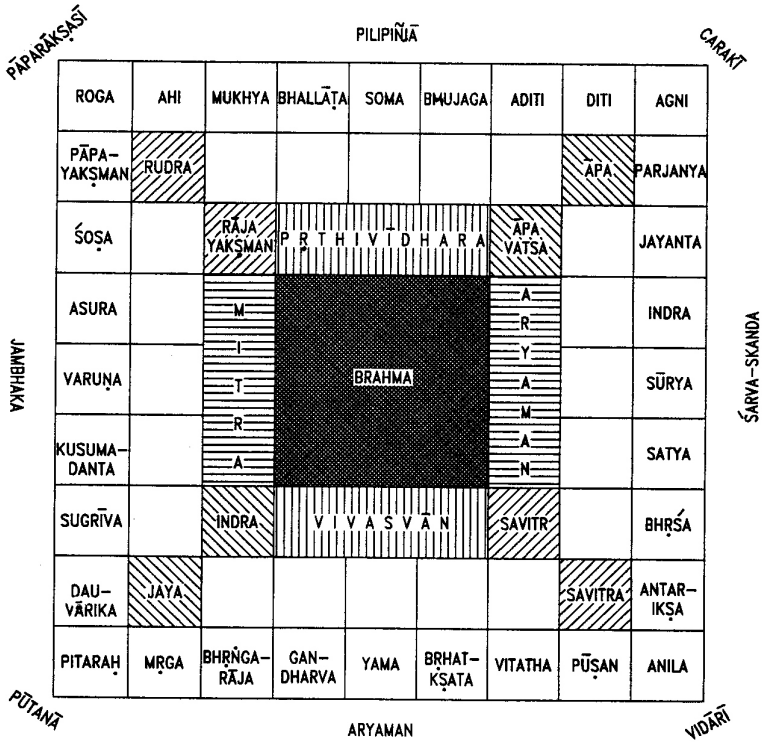

Figure 5. Plan for a sacred structure or house according to Vāstu texts

THE VEDIC HOUSE

The Ṛgveda speaks of settled space as *grāma* in opposition to the forest as *araṇya* (RV 10.90). But within the grāma could be a fort or high town (*pur*). The *pur* made of stone is mentioned in RV 4.30.20. *Pura*s made of metal (iron) are mentioned several places such as 1.58.8, 7.3.7, 7.95.1, 10.101.8.

The place of residence of the individual or joint family was *gṛha*, and *grāma* was a collection of *gṛhas*. The devatā presiding over each house was called *vāstoṣpati*. Among the many names for residence are *gṛham, geha, gaya, pastyam, duronam, duryah, damah, okah, yonih, dhāman, niveśanam, chardis, vartih, veśman, varutham, śaraṇam, vāstuh, śarman, sadanam, sadas, harmyam, vidatham, guhā, kṣayah, amā, svasram, ajman, chāyā*, and so on. From a cognitive point of view, the fact of so many different names being used for a dwelling indicates a wide variety of styles and sizes.

An ordinary house with roof was *chardis* (RV 6.15.3); a mansion was called *harmyam,* which would have several rooms, parents, many women, and even a guard dog at the door (RV 1.166.4, 7.55.6, 10.55.6); and a multi-residence complex, together with halls for animals, was called *gotra*. The description of *harmyam* suggests that it had an open courtyard in the middle and quarters for women at the back. This indicates that the form was similar to the recommended plan of the later vāstu śāstra texts. Sāyana took the description in 7.55.6 to stand for a *prāsāda* (palace).

Palaces with a thousand doors and a thousand pillars are also mentioned. Renou took a similar description in RV 10.18.12 to be a metaphor, arguing,[6] "in one passage of a funerary hymn…the poet supplicates the Earth to allow a thousand pillars to be raised in the cavity where the dead repose, so that her weight will not crush those who take refuge in her breast." However, such a plausible explanation does not work for the reference to such large palaces in RV 2.41.5, 5.62.6, 7.88.5.

To consider the poetic description of a dwelling, we look at RV 7.55, addressed to Vāstoṣpati:

Ṛgveda 7.55

Evil-dispelling Vāstoṣpati, who takes every form,
be an auspicious friend to us. (1)

O shining son of Saramā, reddened, you show your teeth,
which gleam like lances' points in your mouth when you bite. Go to sleep. (2)

Saramā's son, retrace your way: bark at the robber and the thief.
Why do you bark at Indra's singers? Why do you terrify us? Go to sleep. (3)

Be on guard against the boar, and let the boar beware of you.
Why do you bark at Indra's singers? Why do you terrify us? Go to sleep. (4)

Sleep mother, sleep father, sleep dog, sleep master of the house.
Sleep all kinsmen; sleep all the people who are around. (5)

He who sits, he who walks, and he who sees the people,
we closely shut their eyes; so we shut this house (*harmyam*). (6)

The thousand horned bull, which rises up from out the sea,
by his strength we lull and make the people sleep. (7)

Girls sleeping in the court or stretched on beds,
sweet-scented women, these, one and all, we lull to sleep. (8)

This hymn clearly refers to a house which is substantial, where several families reside and which has a dog guarding it.

One may also look at the question of the residence from the point of view of complexity. The Vedic society has many specialized professions, as evidenced from the Yajurveda 30, the Puruṣamedha hymn, which lists a variety of secular professions. The

professions include dancer, courtier, comedian, judge, wainwright, carpenter, potter, craftsman, jeweler, bowmaker, ropemaker, dog-rearer, gambler, hunter, fisherman, physician, astronomer (*nakṣatra-darśā*), philosopher, moral law questioner. Further are listed elephant-keeper, horse-keeper, cowherd, shepherd, goatherd, ploughman, distiller, watchman, and the wealthy. Further still, wood-gatherer, wood-carver, water-sprinkler, washer-woman and dyer, servant, courier, snob, pharmacist, fisherman, tank-keeper, cleaner of river-beds, boatman, goldsmith, merchant, and a rhetorician; a cow-slaughterer, speaker, lute-player, forest-guard, a flutist; a prostitute, watchman, musician, hand-clapper. A listing of such diverse professions can only reflect a corresponding complexity in social organization, which would be characterized by different kinds of dwellings.

In two hymns from the Atharvaveda, there is a clear reference to the house as a building. AV 3.12 is a hymn meant to accompany the construction of the house, whereas 9.3 concerns the gifting of the structure built for the ritual to the priest. This latter hymn has been cause of much misunderstanding amongst scholars who are not familiar with the actual practice of ritual, who have taken such a temporary structure to be the prototype of the house in the Vedic village.

Atharvaveda 3.12: TO THE HOUSE **(***At Its Consecration***);** Ṛṣi**:** Brahman

Here I fix my house (*śālā*). May it stand in safety, flowing with prosperity. My we approach you, O House, with all our heroes, our fine heroes, our unharmed heroes. (1)

Stand firm on this spot, O House. Possessed of horses and cattle, and of sweet voices,
rich in food, rich in butter and milk, rise up for great good fortune. (2)

With your lofty roof, O House, and your clean barn, you are a sanctuary for everything. May there come to you in the evening the calf and the boy, and cattle streaming along. (3)

May Savitar, Vāyu, Indra, and Bṛhaspati who knows all, establish this house. May Maruts sprinkle it with water and ghee, and King Bhaga deepen our ploughing. (4)

Lady of the mansion, our shelter, kind Goddess you were first fixed by the devās: May you, robed in grass, be gracious to us, and give us heroes and wealth. (5)

Rise on the post, O beam (*vamśa*), with due order; shine brightly and scare away the foe. Let not those who live in the house suffer. May we live a hundred autumns with our sons. (6)

To it may the little boy, the calf and the cattle come; to it the overflowing pitchers with jars of curds have come. (7)

Lady, bring this full pitcher and the streams of ghee mixed with nectar; and with the nectar anoint the drinkers well. Let what has been offered preserve this house. (8)

I bring this water; free from disease, disease-destroying. I enter this house with immortal fire. (9)

Atharvaveda 9.3: Removal of the structure that has been presented to a priest as sacrificial reward.

We loosen the fastenings of the props, the supports, and the connections of the house (*śālā*) that abounds in treasures. (1)

O (house) rich in all treasures, the fetter and the knot which has been fastened upon you, that with my word do I undo, as Bṛhaspati (undid) Bala. (2)

(The builder) stretched, combined and made your joints firm. With Indra we undo these parts as the butcher separates the joints. (3)

From your beams, ties and bindings, and your thatch; from your wings, (O house) abounding in treasures, we unfasten the joints. (4)

The fastenings of the dove-tailed (joints), of the reed (-covering), of the frame-work, we loosen here from the Lady House. (5)

The hanging vessels within which were set up for enjoyment we loosen from you. Be propitious to us, O Lady House, when you are again set up. (6)

You are an oblation-holder, a fire-altar room, seat for the ladies, seat for the devās, O Lady House. (7)

Your covering of thousand-holed net, stretched out upon your crown, fastened down and put on, we loosen with (this) mantra. (8)

He who receives you as gift, O house, and he by whom you were built, both these, O Lady House, shall attain old age. (9)

Return to him in the other world, firmly bound, ornamented, which we loosen limb by limb, and joint by joint. (10)

He who built you, O house, brought together your timbers, he, a Prajāpati, constructed you, O house, for his progeny. (11)

We pay homage to him (the builder); homage to the giver, the lord of the house; homage to the flowing Agni; and homage to Lord (*puruṣa*). (12)

Homage to the cattle and the horses and to those born in the house. You are rich in births, rich in offspring, and your fetters we loosen. (13)

You cover within the Agni men and animals. You are rich in births, rich in offspring, and your fetters we loosen. (14)

The expanse which is between heaven and earth, with that I receive as gift this house of yours; the middle region which is stretched out from the sky, that I make into a receptacle for treasures; with that I receive the house for this man. (15)

Full of nurture, rich in milk, fixed and built upon the earth, bearing food for all, O house, do not injure those that receive you as gift. (16)

Wrapped in grass, clothed in reeds, the house, place of rest of living creatures, like the night, erected you stand upon the earth, like a she-elephant, firm of foot. (17)

The part of you that was covered with mats unfolding I loosen. You are now enfolded by Varuṇa, may Mitra uncover in the morning. (18)

The house fixed with mantra, fixed, built by seers -- may Indra and Agni, the immortals, protect the house, the seat of Soma. (19)

A nest upon a nest, a vessel pressed together in a vessel, a mortal man is born, from whom all things spring. (20)

Built with two wings, four wings, six wings; in the house with eight wings, with ten wings, in the Lady House, Agni rests as if in the womb. (21)

Turning towards you who are turned towards me, uninjuring, O house, I come to you facing the west. Within are Agni and the waters, the first door to divine order. (22)

> These waters, free from disease, destructive of disease, I bring here. I set forth into the house in company with the immortal Agni. (23)
>
> Do not fasten a fetter upon us; though a heavy load, become you light. Like a bride we carry you, O house, where we please. (24)
>
> From the eastern quarter, homage to the greatness of the house. Hail to the gods who are to be hailed. (25)
>
> From the southern quarter, homage to the house… (26)
>
> From the western quarter, homage to the house… (27)
>
> From the northern quarter, homage to the house… (28)
>
> From the firm quarter, homage to the house… (29)
>
> From the upward quarter, homage to the house… (30)
>
> From every quarter, homage to the greatness of the house. Hail to the gods who are to be hailed. (31)

We see that the house could be of many sizes, with two, four, six, eight, or ten wings. (9.3.21). The dwelling is said to be built by the poets, *kavi* (9.3.19), indicating high regard in the society for both builders and designers. The house is said to be the home of Soma (9.3.19); it adjusts itself to all just like a new bride adjusts to the members of the [the large] family. The Vedic poets viewed a house not merely as an inanimate block of sand and grass, but as a living entity. The divinity associated with the house is addressed in (3.12.5), "Lady of the mansion, our shelter, kind Goddess you were first fixed by the devas: May you, robed in grass, be gracious to us, and give us heroes and wealth." The house consecration ceremony described in this hymn is similar to the one done even today in Hindu families on entering a new home.

THE GODDESS

There is continuity in the worship of the goddess that goes back to the Harappan times and even earlier in the older rock art that has been found at many places in India.[7] The next few figures give examples of the goddess theme in the third millennium India.

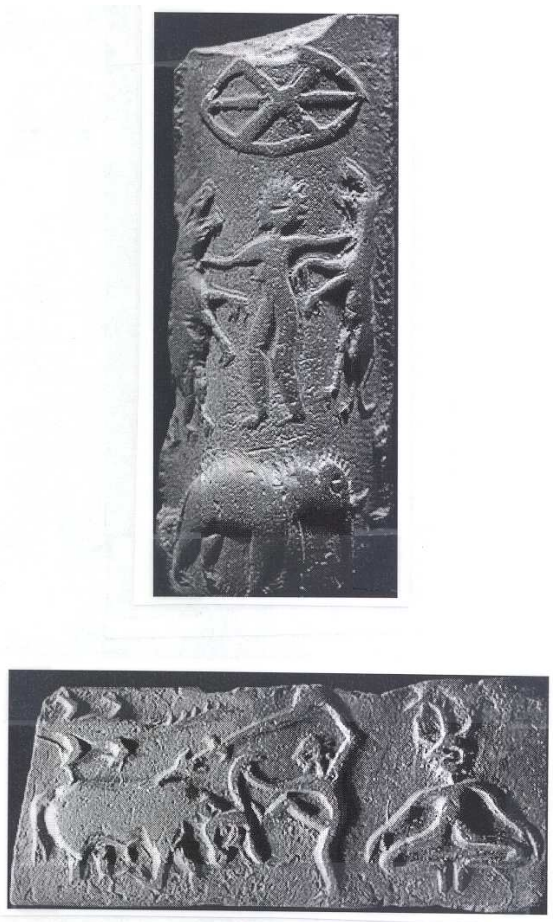

Figure 6. Two sides of a molded tablet showing the goddess battling tiger-demons and killing the buffalo demon as "Paśupati" looks on (Harappa)

Figure 7. Hero/Heroine and the beasts (Mohenjo-Daro)

Figure 8. A cylinder seal from Kalibangan showing the goddess doing battle

From these representations to the images of the Maurya and the Śunga periods represents a transformation whose details are not known. It is noteworthy that Indian themes are seen sometimes in the expatriate communities of Indian artisans and craftsmen before their attested forms within India, pointing to the work that remains to be done within India.

We do not have evidence showing how worship was performed in the Harappan archaeological period. But we have reference to images that were apparently worshiped in the Aṣṭādhyāyī of Pāṇini, the great grammarian of the 5th/4th century BCE. Its terse sutras are written in a technical language in which changes would alter meaning, and its commentaries are attested back to the 4th century. From this text we learn that ordinary images were called *pratikrti* and the images for worship were called *arca* (see As. 5.3.96-100). Patañjali, the 2nd century BCE author of the Mahābhāṣya commentary on the Aṣṭādhyāyī, tells us more about the *pratikrti* and a*rca*.

Amongst other things we are told that a toy horse is called *aśvaka*. (This means that the queen who lay down with the *aśvaka* in the *Aśvamedha* did not sleep with the dead horse.[8]) Deity images for sale were called *Śivaka* etc, but an *arca* of Śiva (Rudra of the earlier times) was just called Śiva. Patañjali mentions Śiva and Skanda deities. There is also mention of the worship of Vāsudeva (Kṛṣṇa). We are also told that some images could be moved and some were immoveable. Pānini also says that an *arca* was not to be sold and that there were people (priests) who obtained their livelihood by taking care of it.

Pāṇini and Patañjali mention temples which were called *prāsādas*. The earlier Śatapatha Brāhmaṇa which is late in the period of the Vedas informs us of an image in the shape of Puruṣa which was placed within the altar.

There is further evidence from the Mahābhārata which is relevant. Although it is generally assigned the period of 400 BCE-400 CE, and the Rāmāyaṇa is assigned a narrower 200 BCE-200 CE, there are grounds to date it much earlier.

The Mahābhārata tradition itself claims that the text was originally 8,800 verses by Kṛṣṇa Dvaipāyana Vyāsa when it was called the Jaya. Later, it was enlarged to 24,000 verses and it came to be called the Bhārata. It was transmitted by Vyāsa to Vaiśampāyana and finally recited by Ugraśravas as the Mahābhārata of the 100,000 verses; the two latter rishis appear thus to be responsible for its enlargements.

The Upanisads speak of texts called Itihāsa-Purāna and although the Mahābhārata is called Itihāsa, there is no certainty that this was the only such Itihāsa text that has ever existed. It is generally conceded that there may have been an old kernel of the story going back to the Mahābhārata War. This is where Dāksiputra Pānini has something very important to say. He speaks of the Bhārata and the Mahābhārata in one of his sūtras (6.2.38). This means that the epic was substantially complete by 500 BCE, although it may have undergone further modifications and interpolations in subsequent centuries.

The Mahābhārata was an encyclopaedia of its times. One of the most revolutionary things happenings in the religious life of the people during 400 BCE to 400 CE was the rise of Buddhism. But examine the hundreds of pages of the epic on religion and there is no mention of it. The only religions mentioned in the text are: Vedic, Sāṅkhya, Yoga, Pāśupata, and Bhāgavata. We cannot argue that the rishis who wrote the Mahābhārata kept one of the most important religious ideas of their times out of the story just because they knew this would become controversial in the 20th century.

Even the political life described in the Mahābhārata does not correspond to the imperial phase of the 400 BCE - 400 CE. Cattle raids are the big thing in it, not imperial conquest. There are also no references in the epic to the Saiśunāga kings, the Mauryas, the Śungas, or the later dynasties. The Buddhist Jātakas that were written during these royal dynasties, on the other hand, are aware of the characters of the epic. One Jātaka, for example, speaks disparagingly of Draupadi for having had five husbands.

Next is the matter of the unicorn of the Harappan iconography, which is a composite animal whose neck and snout resemble those of the horse or camel, while the legs are equine. The body and the tail are that of the bull. The Mahābhārata speaks of the unicorn, which points to further continuity with the Harappan period. The Purānas call Viṣṇu and Śiva by the name of *Ekaśṛṅga*, the "one-horned one." The *Śānti-Parva* (chapter 343) of the Mahābhārata speaks of the one-tusked boar (Varāha) who saves the earth as Viṣṇu's incarnation. Here Varāha is described as being triple-humped, a figure that we see in the Harappan iconography. In some engravings, the Harappan unicorn's horn appears to be coming out from a side. In the Sanskrit texts, we have the figure of *Śankukarṇa*, "one whose ear is like a nail." The Mahābhārata (*Vana Parva*) informs that there is a temple to Śiva in the name of *Śankukarṇa Mahādeva* at the point where the river Sindhu meets the sea.

The Matsya Purāṇa tells us that this Varāha is the same as the Vṛṣākapi of the Rgveda. The lexicographer Amarasiṃha asserts that Vṛṣākapi represents both Viṣṇu and Śiva.

Varāha, the heavenly boar-unicorn, is described in the Purāṇas as having muscular, round and long shoulders, a high waist, and shape of a bull. The different parts of this animal are pictured as representing the Vedas, the altar and so on. It has been suggested that Varāha

originally meant this composite unicorn and it was only later that the meaning was transferred to that of boar.

CONTINUITY AND EVOLUTION

The continuity between Harappan reliefs and the Buddhist art, as well as between the Paśupati form of Śiva in Harappa and its representation in later Yoga systems was noted by Kramrisch[9] and other scholars. But there is continuity in the concern with repetition and infinite extension that goes back to the much earlier rock art (Figure 9).

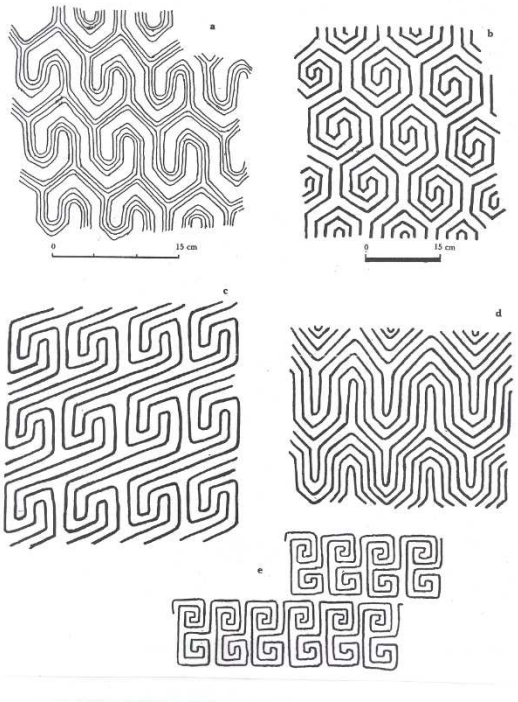

Figure 9. Tesselations in ancient Indian rock art

VEDIC METAPHORS IN INDIAN ART

Kapila Vatsyayan has described seven metaphors for Indian art:[10]

1. The seed (bīja) to represent the beginnings. From the Ṛgveda to the Nāṭyaśāstra to the Tantrasamuccya. The fruit of *āmalaka* seen as the finial in temple architecture.

2. The vṛkṣa (tree) that rises from the bīja (seed). The vṛkṣa is the vertical pole uniting the earth and heaven. The yūpa of the yajña is the skambha or the stambha (pillar), the *axis mundi* of the universe. The purusa as primal man is superimposed on the vrksa or the stambha.

3. The centre of the purusa is the *nābhi* (navel) or the *garbha* (womb). It is distinct from verticality and brings together the concepts of the unmanifest (avyakta) and manifest (vyakta).

4. The bindu (point or dot) as the reference, or metaphorical centre, around which by drawing geometrical shapes, notions of time and space are apprehended.

5. The śūnya (void) as a symbol of fullness and emptiness. From its arūpa (formless) nature arises rūpa (form) and the beyond form (parirūpa).

6. The equivalence of śūnya with pūrna. The paradox that the void has within it the whole.

7. The relationship of the subject to the creation through light (jyoti), which represents illumination, tejas, sūrya and cit. This light is represented by agni bindu or sūrya bindu which brings us back to the bindu of the bīja.

WRITING

It is generally known that modern Indian scripts, such as Devanāgarī, Telugu, Tamil, Bengali, are less than two thousand years old and that they sprang from Brāhmī, which, in turn, is at least 2,500 years old. Early writings of Brāhmī, discovered in Sri Lanka, have been dated tentatively to about 500 BC; the more commonly known Brāhmī records belong to the reign of the Mauryan King Aśoka (250 BC). According to B.B. Lal[11], some marks that are apparently in Brāhmī on pottery in India go back to about 800 or 900 BCE. The Indus script (also called Harappan or Sarasvatī) was used widely during 2600-1900 BCE. Its starting has been traced back to 3300 BCE and its use continued sporadically into the late centuries of the second millennium BCE.

We know that writing was used in India prior to 500 BCE. Written characters are mentioned in the Chāndogya and the Taittirīya Upanisad, and the Aitareya Āraṇyaka refers to the distinction between the various consonant classes. The voluminous Vedic texts also contain hints of writing in them. For example, Ṛgveda 10.71.4 says:

> *uta tvaḥ paśyan na dadarśa vācam uta tvaḥ śṛṇvan na śṛṇoty enām*
> One man has never seen Vāk, yet he sees; one man has hearing but has never heard her.

Since Vāk is personified speech, it suggests knowledge or writing. Another verse (RV 10.62.7) mentions cows being marked by the sign of "8". The Atharvaveda (19.72) speaks of taking the Veda out of a chest (*kośa*), and although it may be a metaphor for knowledge coming out of a treasure-house, it could equally have been meant in a literal sense.

The traditional date for the Rgveda is about 3000 BCE, with the later Vedic texts and the Brāhmanas coming a few centuries later. The Āranyakas, Upanisads and the Sūtras are, in this view, dated to the 2nd and early 1st millennia. The astronomical evidence in the texts is in accord with this view. Furthermore, the currently accepted date of 1900 BCE for the drying up of the Sarasvati river, hailed as the mightiest river of the Vedic age with its course ranging from the mountain to the sea, implies that the Vedas are definitely prior to this date. It is also significant that the Brāhmana texts speak of the drying up of the Sarasvati as a recent event.

This brings the Vedas to the period of the use of the Indus script in India. It is also significant that the geography of the Harappan region corresponds to the geography of the Ṛgveda.

Even if one accepted the colonial chronology of ancient India, the period of the Rgveda corresponds to the later period of the Harappan culture. This means that the Indus script is likely to have been used to write Sanskrit and other languages spoken in the 3rd millennium India just as Brāhmī was used to represent north and south Indian languages 2,500 years ago.

There are many competing theories about the nature of the Indus script. The main difficulty with "proving" any decipherment is that the texts are very short.

Some historians believe that Brāhmī is derived from one of the West Asian scripts and, indeed, there are interesting similarities between their characters for several sounds. On the other hand, there is a remarkable continuity between the structures of Indus and Brāhmī. Since a script can be used to write a variety of languages—even unrelated--, the question of structural relationship is particularly interesting.

Indus and Brāhmī connections become evident when one considers the most commonly occurring letters of the two scripts. In a series of articles[12] in *Cryptologia*, I examined these connections for similarity in form, case-endings for inscriptions, and the sign for "ten". The parallels are extraordinary and the probability that they arose by chance is extremely small.

Since the technical arguments related to the relationship between the two scripts are beyond the scope of this article, let me only reproduce the ten most likely letters from the two scripts (*Tables 1 and 2*).

Notice that the three most commonly occurring letters in both the scripts are the "jar", the "fish", and the "man". The number of matches in the ten signs is 7; the probability of this happening by chance is less than 10^{-12}.

It is also remarkable that the "fish" sign is used as a symbol for "10" in the Indus (used without the gills; its use was determined by a statistical analysis) and the Brāhmī scripts, although the Brāhmī "fish" for "10" is shown sideways.

Table 1: Ten most common Brahmi letters in rank order and with percentage

Rank	1	2	3	4	5	6	7	8	9	10
Brahmi sign										
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

Table 2: Ten most common Indus signs (Mahadevan Concordance)

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

Regarding the similarities between Brāhmī and early Semitic scripts, it should be noted that Indic kingdoms, in which Sanskrit names were used, were prominent in West Asia in the second millennium BC. Just as in the Vedic system, the Ugaritics, a people closely related to the Phoenicians and the Hebrews, have 33 gods. More importantly, Yahvah, the name of God in the Judaic tradition, occurs as an epithet for Agni in the Ṛgveda a total of 21 times (*yahva* in RV 10.110; *yahvah* in RV 3.1, 3.5, 4.5, 4.7, 4.58, 5.1, 7.6, 7.8, 9.75, 10.11; *yahvam* in RV 1.36; 3.3; 4.5; 5.16; 8.13; 10.92*; yahvasya* in RV 3.2 and 3.28). Indian ideas on writing may thus have, through the agency of the powerful Mitanni kingdom of Syria, influenced the various Semitic traditions of the second and first millennia BCE.

TEMPLES AND IMAGES

The temple (*devālaya*) is the house for the God or Goddess. The Vāstu texts present the temple plan as homological to a human body. The human body serves as the plan for all creation as in the Purusa-sūkta. The temple structure is homologous to the standing purusa as the *śilpa-pañjara*. At a lower level, a similar measure informs the proportions of the sculpted form, that may be standing or seated, and also of painted figures. This body at its deepest level is a body of knowledge. The structure of music is also to be conceived as such a body; hence one can speak of the *saṅgīta-puruṣa*, where there exist precise relationships between ascending and descending notes. According to Śārṅgadeva, the musical composition is endowed by the composer with eyes, hands, and feet: it must have balance between opposites: symmetry and asymmetry, movement and pause, recurrence and variation.

The focus of the devālaya is the sanctuary, *garbhagṛha*, which is typically a dark, unadorned cell, with a single doorway facing the east. Only the priest is permitted to enter the *garbhagṛha* to perform rituals on behalf of the devotee or the community.

In the words of Stella Kramrisch,[13] "The temple is the concrete shape (*mūrti*) of the Essence; as such it is the residence and vesture of God. The masonry is the sheath (kośa) and body. The temple is the monument of manifestation [p. 165]." The expansion may be seen

either as proceeding from the central point of the *garbhagṛha* in all the directions of space, reaching to the bindu above the finial of the temple and beyond, or as a manifestation held together by a tension between the *bindu* and the g*arbhagṛha*, with the axis joining the two being the world axis.

The Indian temple tradition falls into two broad categories,[14] the Nāgara and the Drāvida, whose separation from the earlier tradition is traced back to the middle centuries of the first millennium. In addition, the texts speak of a hybrid category, called Vesara, which in Sanskrit means "mule" that emphasizes this hybridicty.

The *mūrti* in the *garbhagrha* stands on its pedestal (*pītha*). A Vaisnava temple has an image of Viṣṇu, a Śaiva temple has a lingam, and a Devi temple has the image of the Goddess.

The *garbhagṛha* is enclosed by a superstructure, and the nature of this superstructure makes the distinction between the Nāgara and the Drāvida type. The Nāgara temple, the mūlaprāsāda, is enclosed by a curved spire (śikhara), while the Drāvida temple has a tiered pyramid form with a crowning top which is called the vimāna. The temple is the embodiment or manifestation of the deity, therefore the names of certain temple parts, as given in Sanskrit, are anthropomorphic: *grīva* = neck, *skandha* = shoulder, *ūru*= thigh, *jangha* = lower leg. The *cakras* visualised in the practice of yoga are analogous to the stages up the vertical axis of the temple tower in the South Indian temple and it is marked by corresponding levels in the exterior.

Typically, the temple has a stone or brick structure, which is in the image of a wooden building. Where it is too difficult or expensive to construct a stone or masonry temple, it may be built of wood or any other available material. The idea behind use of stone, but in the image of wood -- normally the building material for the residential house -- is to project that the wooden, or human, nature of the conception is to find expression in the much more permanent stone just as the transcendent category of divinity is given the iconic expression derived from the human world.[15]

There is also the question of the details of the superstructure, and we see repeated forms and motifs, to different scales. This represents the fundamental Vedic idea of recursion in reality. The recursion is also seen in exterior decoration and composition and its basic compositional elements and grammar related to the joining of these elements has been described in the texts. Adam Hardy sees these elements as shrine-images or aedicules, conceived three-dimensionally and embedded in the body of the temple and on the superstructure.

The temple, together with its images, represents movement and change. This is achieved by the use of projection, extension and repetition across different scales. An extension at the centre of the body of the form is a *bhadra*; when located at the corner, it is a *karma;* located between the *bhadra* and the corner, it is a *pratibhadra*. Their use in different ways creates unique representations out of the basic Vāstu puruṣamaṇḍala.

Movement is also expressed by increasingly concrete representation of an image, from *niṣkala* to *sakala*. To illustrate the last idea, the emanations of Śiva are in the form of a formless linga as the axis of materiality and consciousness (*niṣkala*), to the intermediate

niṣkala-sakala mukha-linga which has faces in cardinal directions (Sadāśiva), to the *sakala* Maheśa (the anthropomorphic Śiva).

There are also other variations: Śiva with one face and two hands, or with four hands; Śiva with four, five, eight, or twelve faces; Śiva with bull, lion, or elephant; Śiva and Parvatī; Ardhnārīśvara, Harihara, Dakṣiṇāmūrti, and Aja-Ekapad. The faces emerging out of the plain liṅga, along the cardinal directions, are those of Sadyojāta, Aghora, Tatpuruṣa, and Vāmadeva. For Maheśa, the corresponding emanations are Śiva, Viṣṇu, Sūrya, and Brahmā.

Śiva inheres in himself all contradictions, just as is the case with our reality. He grants wealth and prosperity but is himself clad in elephant hide and he is a beggar; he is personification of asceticism, yet half of his body is that of his consort. Śiva manifests in different forms: as *viśva-rūpa* or the universe, as *liṅga-śarīra* in the hearts of beings, and as the omnipresent *antar-ātman* in the heart of all beings.

Śiva is also known as Maheśvara, the great Lord, Mahādeva, the great God, and Mṛtyuñjaya, conqueror of death. He is the spouse of Śakti, the Goddess. His usual mantra is *om namah śivāya*. He is a yogin. When symbolized as the Sun at dawn in conjunction with the moon, he is shown with matted locks with the crescent moon, from which streams the river Ganga, symbolic of the Milky Way. He is smeared with ash, symbolizing all that remains at the dissolution of the universe. This dissolution occurs when his third eye opens, which refers to one's symbolic death and renewal with the realization of one's consciousness, which is Śiva. His right hand shows the mudrā dispelling fear, while in his left he holds the trident, symbol of the three worlds, on which is bound the ḍamaru.

Viṣṇu is most famous for *trivikram,* the three steps that measure out the universe. These three steps represent the order in change (*vikrama*) that binds the three worlds of the outer, the inner, and the elements. Viṣṇu is God in its moral embodiment, represented by word and form, whereas Śiva is the inner core of reality. Viṣṇu is the universe, Śiva is its axis.

The dichotomy of the phenomenal world may be seen through the lens of ongoing change associated with Nature, or prakrti. According to the Tantras, transcendent reality manifests itself in to the pair Śiva and Śakti. Śiva, paradoxically, is the cause of bondage; Śakti the force of liberation. The Goddess is the life force of the universe. She is represented by the vowel "I" in Śiva's name; without it Śiva is Śava, a dead body.

In Śiva temples, the lingam is generally placed before an image of his vehicle (*vāhana*) Nandi the bull.

RITUAL AND TRANSFORMATION

The temple ritual is meant for self-transformation. In its most iconic form it is the Vedic sacrifice, which is the hallmark of sacred theatre. But this theatre need not be done externally, and it may also be performed through mediation.

As pūjā, worship consists of nyāsa (establishing the icon), dhyāna (meditation), upacāra (offering), and japa (mantra recitation). The upacāra of the mūrti is done in 16 steps: āsana (establishing the mūrti), svāgata (welcome), pādya (water for washing feet), arghya (rice, flowers), ācamana (sipping water), madhuparka (honey, ghee, milk, curd), snāna

(bathing), vāsana (clothes), ābhāraṇa (gems), gandha (perfume and sandal), puśpa (flowers), dhūpa (incense stick), dīpa (flame), naivedya (food) and namaskāra (prayer).

The temple is the seat of secret teaching, as well as formal education in the pāthaśālā (school). It is also the place where creativity that connects the devotee to Īśvara is cultivated; hence it is also the seat for dance.

The relationship between dance and architecture has been addressed by Kapilā Vātsyāyan[16] and Padmā Subrahmanyam.[17] Their work reinterprets śāstric material, especially the *karaṇa* of the dance as described in the Nāṭyaśāstra. Padmā Subrahmanyam's central intuition was that the *karaṇas* of the Nāṭyaśāstra were representative of movement and not static posture. This was confirmed in the work by Alessandra Iyer[18] in her analysis of the dance poses found in the great ninth century Śiva temple at Prambanan in Java.

In śāstric dance, the *aṅgahāras* and the *piṇḍīs* form the larger grouping of *karaṇas*. This is in accord with the repetition and enlargement of basic forms in the temple architecture.

CONCLUDING REMARKS

This article began by showing the error in the analysis of Coomaraswamy and Renou of the Vedic house, which has misled generations of art historians. It was shown that the Atharva-vedic descriptions of the structure, that have long been taken to describe the typical Vedic house, actually deal with the temporary shed that is established in the courtyard of the house in connection with householder's ritual.

The article further dealt with the continuity between Harappan and historical art and writing and it filled in the gap in the post-Harappan, pre-Buddhist art of India by calling attention to the structures in northwest India (c. 2000 BCe) that are reminiscent of Puranic ideas. It summarized evidence related to the Vedic ideas of sacred geometry and its transformation into the classical Hindu temple form. We have also explored the connections that tie the details of the temple form and its iconography to fundamental Vedic ideas related to transformation.

There also exist interesting questions of the relationship between Indian and Western art and diffusion of ideas.[19] In particular, there exist interesting parallels between Indian and European religious architecture that are worthy of further study. These will be taken up in a future article.

NOTES

[1]This material has been reprinted and is available as Ananda K. Coomaraswamy, *Essays in Early Indian Architecture*. Indira Kalakendra and Oxford University Press, Delhi, 1992, and Louis Renou, "The Vedic house." *Res*, 34, 143-161, 1998, both edited by Michael W. Meister.

[2]Coomaraswamy, *Essays in Early Indian Architecture*, page 3.

[3]Renou, *op cit,* pages 160-1.

[4]M.K. Dhavalikar and Shubhangana Atre, "The fire cult and virgin sacrifice: some Harappan rituals." In *Old Problems and New Perspectives in the Archaeology of South Asia*, J.M. Kenoyer (ed.). Dept of Anthropology, University of Wisconsin, 1989, pp. 193-205.

[5]V.I. Sarianidi, *Drevnie zemeldel'tsy Afganistana*. Moskva, 1977. For a contextualized discussion of this structure, see S. Kak, The Astronomical Code of the Rgveda. Munshiram Manoharlal, New Delhi, 2000.

[6]Renou, *op cit*, Section 18, page 157.

[7]S. Kak, "Mind, immortality and art." In *Rūpa-Pratirūpa, Mind Man and Mask,* S.C. Malik (ed.), Indira Kalakendra, New Delhi and Aryan Books International, 2001, pp. 16-27. See also, S. Kak, "Ritual, masks, and sacrifice." Studies in Humanities and Social Sciences, IIAS Shimla, vol. 11, 2004, pp. 29-44.

[8]See S. Kak, *The Aśvamedha.* Motilal Banarsidass, Delhi, 2002 for details and analysis of this rite.

[9]S. Kramrisch, *The Presence of Śiva*. Princeton University Press, 1992.

[10]K. Vatsyayan, *The Square and the Circle of Indian Arts.* Abhinav Publications, New Delhi, 1997.

[11] B.B. Lal, *The Earliest Civilization of South Asia.* Aryan Books International, 1997.

[12]S. Kak, A frequency analysis of the Indus script. *Cryptologia.* 12:129-143, 1988; S. Kak, Indus writing. *Mankind Quarterly*. 30:113-118, 1989; S. Kak, Indus and Brāhmī: Further Connections. *Cryptologia.* 14:169-183, 1990; S. Kak, Evolution of early writing in India. *Indian Journal of History of Science.* 29: 375-388, 1994; S. Kak, An Indus-Sarasvati signboard. *Cryptologia.* 20: 275-279, 1996.

[13]S. Kramrisch, *The Hindu Temple.* University of Calcutta, Calcutta, 1946.

[14]M.W. Meister (ed.), *Encyclopaedia of Indian Temple Architecture.* Vol. 1, pt 1, *South India, Lower Drāvidadeśa*. AIIS, New Delhi, 1983; M.W. Meister and M.A. Dhaky (ed.), *Encyclopaedia of Indian Temple Architecture.* Vol. 1, pt 2*, South India, Upper Drāvidadeśa*. AIIS, New Delhi, 1986; M.W. Meister, M.A. Dhaky, and Krishna Deva (ed.), *Encyclopaedia of Indian Temple Architecture.* Vol. 2, pt 1*, North India, Foundations of North Indian Style*. AIIS, New Delhi, 1988; A. Hardy, *Indian Temple Architecture: Form and Transformation.* Indira Gandhi National Centre for the Arts and Abhinav Publications, New Delhi, 1995; M.W. Meister (ed.), *Discourses on Śiva.* University of Pennsylvania Press, Philadelphia, 1984.

[15]S. Kak, *The Gods Within*. Munshiram Manoharlal, New Delhi, 2002.

[16] Kapila Vatsyayan, *Classical Indian dance in Literature and the Arts.* Sangeet Natak Akademi (1st edition 1968), New Delhi, 1977.

[17]Padma Subrahmanyam, *Karana in Indian Sculpture*. PhD thesis, Annamalai University, 1978; Padma Subrahmanyam, *Nātya Śāstra and National Unity.* Sri Ramavarma Government Sanskrit College, Tripunithura, Kerala, 1997.

[18]Alessandra Iyer, *Prambanan: dance and sculpture in ancient Java. A study in dance iconography.*

White Lotus, Bangkok, 1998.

[19]A.D. Napier, *Masks, Transformations, and Paradox.* University of California Press, Berkeley, 1986; S. Kak, *L'Arbre a Souhaits - Presence et Promesse de l'Inde.* Editions Banyan, Paris, 2004

27

Art and Cosmology in India*

INTRODUCTION

The best way to understand India is through its art and the cosmology. Textbook narratives often overlook the synthesizing principles that represent the grammar of Indian culture, and they are much like the accounts of the six blind people who encountering an elephant describe it as wall, spear, snake, tree, rope, and fan, respectively.

The three notions that underlie Indian culture are that of *bandhu*, paradox, and *yajña*. *Bandhu* is the binding between the outer and the inner that makes it possible to know, and this is the basis of the pervasive spirituality in India; paradox is the recognition that the *bandhu* must lie outside of rational system, leading to the distinction between the "higher" science of consciousness and the "lower," rational objective science; *yajña* is transformation that the individual undergoes by participating in Vedic "ritual" or any other creative process. The cosmology related to this framework is that of infinity and recursion across scale and time.

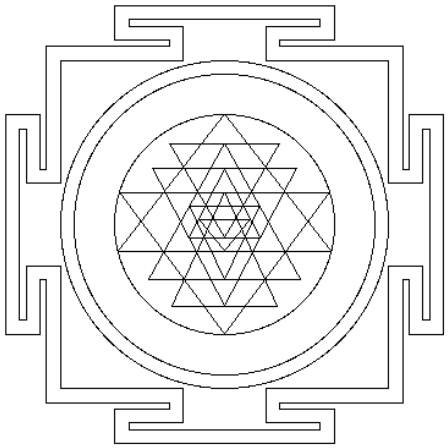

Figure 1. Sri Yantra, which represents the universe recursively

The iconic representation of the universe as the Sri Yantra (Figure 1) shows recursion most clearly. First, the tripartite division into earth, atmosphere, and the sun, which is mirrored in the individual by the body, the breath, and the inner lamp of consciousness, is represented by three triangles. Second, within each triangle are lower hierarchical levels of two other triangles, of alternating opposing polarity that represents male and female principles. All together, this adds up to 9 triangles, which through their overlaps constitute a

* Patanjali Lecture given at Center for Indic Studies, University of Massachusetts, Dartmouth, May 5, 2006; also Sutra Journal (2015)

total of 43 small triangles. Right through the middle of this is the dot, the *bindu that* is Śiva, the Witness, or Consciousness. Nature evolves according to law (*ṛta* in Sanskrit), but it has a paradoxical relationship with the consciousness principle.

Art associated with this conception must communicate recursion, paradox and oppositions concerning ordinary experience of the universe. Aesthetics, as a philosophy of art, is best understood from the point of view of *dhvani,* which communicates, by suggestion, the universals of the outer and inner worlds. Indian thought highlights the connections between these two worlds, and its art presents visions of the cosmos. Thus in Figure 2, a north Indian temple, recursion is expressed in terms of the tower drawn to different scales on the superstructure.

Figure 2. A north Indian temple showing recursion in its outer structural form

Within the temple, the manifestations of the Supreme Being are as the One and its many forms. There exists in them, for example, a hierarchical order of cardinal and peripheral images in relation to the centre, a balancing or pairing of polarities, and representation of the temple as Mount Meru, the centre of the universe. The polarities represented iconographically related to female and male, *asura* (demon) and *deva* (god), left and right, body and mind, and so on. Aesthetics is *alamkara shastra,* that is ornamentation of the central synthesizing principle by means of the particular medium. The poet, *kavi*, is the inspired seer who sees the underlying vision most clearly. Dance, painting, and sculpture, just like poetry, have their canonical ideals, which are the visual equivalents of meter, rhyme, alliteration and the tropes of poetry.

The ritual is organized as sacred theatre that engages the senses to facilitate an epiphany that represents an experiential "rebirth." Great art has the same capacity, and often it is a part of ritual. Not only is the temple a work of art, so is the sculpture that goes into it, and the dance and music performed in its hallways, and the paintings that hang on its walls. One can contrast this with Western conceptions. The cosmology is finite, with God separate from the individual; art is best seen in the sterile atmosphere of the museum or the gallery.

GENERAL EQUIVALENCES

The view that the arts belong to the domain of the sacred and that there is a connection between them is given most clearly in a famous passage in the *Viṣṇudharmottara Purana* in which the sage Markandeya instructs the king Vajra in the art of sculpture, teaching that to learn it one must first learn painting, dance, and music:

Vajra: How should I make the forms of gods so that the image may always manifest the deity?

Markandeya: He who does not know the canon of painting (*citrasutram*) can never know the canon of image-making (*pratima lakshanam*).

Vajra: Explain to me the canon of painting as one who knows the canon of painting knows the canon of image-making.

Markandeya: It is very difficult to know the canon of painting without the canon of dance (*nritta shastra*), for in both the world is to be represented.

Vajra: Explain to me the canon of dance and then you will speak about the canon of painting, for one who knows the practice of the canon of dance knows painting.

Markandeya: Dance is difficult to understand by one who is not acquainted with instrumental music (*atodya*).

Vajra: Speak about instrumental music and then you will speak about the canon of dance, because when the instrumental music is properly understood, one understands dance.

Markandeya: Without vocal music (*gita*) it is not possible to know instrumental music.

Vajra: Explain to me the canon of vocal music, because he, who knows the canon of vocal music, is the best of men who knows everything.

Markandeya: Vocal music is to be understood as subject to recitation that may be

done in two ways, prose (*gadya*) and verse (*padya*). Verse is in many meters.

Some of the early meters range from the *gayatri* with 3 sections of 8 syllables (3 × 8 = 24) to *anushtubh* (4 × 8 = 32), *viraj* (4 × 10 = 40), *trishtubh* (4 × 11 = 44), and *jagati* (4 × 12 = 48). These appear to be connected to the astronomical number 360, the number of civil days in the year. There are also many other more complex meters, with a less obvious astronomical basis.

To understand the principle behind the broader equivalences of Indian art and its cosmology, it is good to begin with the fire altars of the Vedic period that were themselves designed to represent astronomical (outer) as well as inner knowledge. An assumed equivalence between the outer and the inner cosmos is central to the conception of the temple, which is why numbers such as 108 and 360 are important in its design.

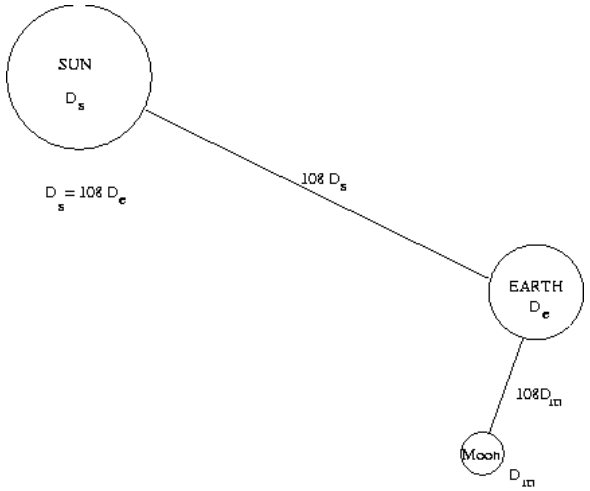

Figure 3. The number 108 in the distance from the earth to the sun and the moon

The number 108 represents the approximate distance from the earth to the sun and the moon in sun and moon diameters, respectively. (The diameter of the sun is also 108 times the diameter of the earth, but that fact is not likely to have been known to the Vedic rishis.) This number of dance poses (*karanas*) given in the Natya Shastra is also 108, as is the number of beads in a rosary (*japamala)*. The "distance" between the body and the inner sun is also taken to be 108, so that the number of joinings is 107. Not surprisingly, the number of *marmas* in Ayurveda is 107. The total number of syllables in the Ṛgveda is taken to be 432,000, a number related to 108.

The number 360 is taken in the Ayurvedic texts to be the number of bones in the developing fetus, a number that fuses later into the 206 bones of the adult. The centrality of this number in Vedic ritual is stressed in the Shatapatha Brahmana.

The primary Vedic number is three, representing the tripartite division of the physical world into the earth, the atmosphere, and the sky and that of the person into the physical body, the *prāṇas*, and the inner sky.

The Vedic altars had an astronomical basis related to the reconciliation of the lunar and solar years, which mirrors the reconciliation of the female and male currents within the body and mind of the individual. The fire altars symbolized the universe and there were three types of altars representing the earth, the space and the sky. The altar for the earth was drawn as circular, whereas the sky (or heaven) altar was drawn as square.

The fire altars were surrounded by 360 enclosing stones, of these 21 were around the earth altar, 78 around the space altar and 261 around the sky altar. In other words, the earth, the space, and the sky are symbolically assigned the numbers 21, 78, and 261. Considering the earth/cosmos dichotomy, the two numbers are 21 and 339 since cosmos includes the space and the sky.

The main altar was built in five layers. The basic square shape was modified to several forms, such as falcon and turtle. These altars were built in five layers, of a thousand bricks of specified shapes. The construction of these altars required the solution to several geometric and algebraic problems.

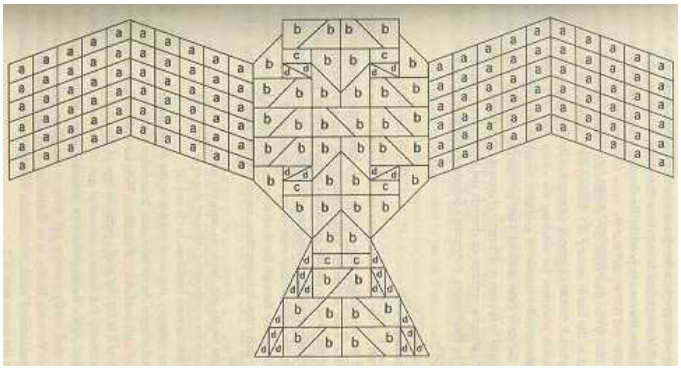

Figure 4: The falcon altar

Two different kinds of bricks were used: the special and the ordinary. The total number of the special bricks used was 396, explained as 360 days of the year and the additional 36 days of the intercalary month. Two kinds of day counts: the solar day, and *tithi*, whose mean value is the lunar year divided into 360 parts.

Three different years were considered: (i) nakshatra, or a year of 324 days (sometimes 324 tithis) obtained by considering 12 months of 27 days each, where this 27 is the ideal number of days in a lunar month; (ii) lunar, which is a fraction more than 354 days (360 tithis); and (iii) solar, which is in excess of 365 days (between 371 and 372 tithis).

A well-known altar ritual says that altars should be constructed in a sequence of 95, with progressively increasing areas. The increase in the area, by one unit yearly, in building progressively larger fire altars is 48 tithis which is about equal to the intercalation required to make the nakshatra year in tithis equal to the solar year in tithis. But there is a residual excess which in 95 years adds up to 89 tithis; it appears that after this period such a correction was made. The 95-year cycle corresponds to the tropical year being equal to 365.24675 days. The

cycles needed to harmonize various motions led to the concept of increasing periods and world ages.

The number of syllables in the Ṛgveda confirms the textual references that the book was to represent a symbolic altar. According to various early texts, the number of syllables in the Ṛgveda is 432,000, which is the number of muhurtas in forty years. In reality the syllable count is somewhat less because certain syllables are supposed to be left unspoken. The organization of the Ṛgveda is also according to a plan, but that is a different story told in my book *The Astronomical Code of the Ṛgveda.*

The verse count of the Ṛgveda can be viewed as the number of sky days in forty years or 261 × 40 = 10,440, and the verse count of all the Vedas is 261 × 78 = 20,358.

The Brāhmaṇas and the Śulbasūtras tell us about the altar of *chandas* and meters, so we would expect that the total Ṛgvedic hymn count of 1017 and the group count of 216 have particular significance. Owing to the pervasive tripartite ideology of the Vedic books we choose to view the hymn number as 339 × 3. The tripartite ideology refers to the consideration of time in three divisions of past, present, and future and the consideration of space in the three divisions of the northern celestial hemisphere, the plane that is at right angle to the earth's axis, and the southern celestial hemisphere. The number 339 is simply the number of disks of the sun or the moon to measure the path across the sky: π times 108 is approximately 339. The *Rgvedic* code then expresses a fundamental connection between the numbers 339 and 108. The numbers 108 and 360 appear as the axis and the perimeter dimensions of the temple.

TEMPLES AND GODS

The temple is considered in the image of the Cosmic Puruṣa, on whose body is displayed all creation in its materiality and movement. Paradoxically, the space of the Puruṣa (Ṛgveda 10.90) is in the sanctuary only ten fingers wide, although he pervades the earth.

The outer cosmos is expressed in terms of various connections between the temple structure and the motions of the sun, the moon, and the planets; the inner cosmos is represented in terms of the divinity (universal consciousness) in the womb of the temple and various levels of the superstructure that correspond to the states of consciousness. The position of the gods in the *Vāstupuruṣa-maṇḍala* within the temple is a symbolic representation of the spatial projections of the cosmic Puruṣa in his body. There are other iconic representations of sacred space, as in the Śri Yantra where the body's three parts – *vāgbhava, madhya*, and *mūla* – have recursive structures within, that represent Vedic cosmology in a unique fashion.

The prototype of the temple is the *Agnikshetra,* the sacred ground on which the Vedic altars are built. The Agnikshetra is an oblong or trapezoidal area on which the fire altars are built. During the ritual is installed a golden disc (*rukma*) with 21 knobs or hangings representing the sun with a golden image of the purusha on it. The detailed ritual includes components that would now be termed Shaivite, Vaishnava, or Shakta. In Nachiketa Agni, 21 bricks of gold are placed one top of the other in a form of Śivalinga. The disk of the *rukma,*

which is placed in the navel of the altar on a lotus leaf is in correspondence to the lotus emanating from Viṣṇu's navel which holds the universe. Several bricks are named after goddesses, such as the seven krittikas.

Figure 5. Ganesha: elephant-headed, wise, with mouse as his vehicle

The Hindu temple represents the Meru mountain, the navel of the earth. It is the representation of the cosmos both at the level of the universe and the individual, making it possible for the devotee to get inspired to achieve his own spiritual transformation. The purusha placed within the brick structure of the altar represents the consciousness principle within the individual. It is like the relic within the stupa. The threshold to the inner sanctum is represented by the figure of Ganesha (Figure 5), who, like other divinities, symbolizes the transcendence of oppositions.

The temple construction begins with the *Vastupurusha mandala*, which is a yantra, mostly divided into 64 (8 × 8) or 81 (9 × 9) squares, which are the seats of 45 divinities. Brahma is at the centre, around him 12 squares represent the Adityas, and in the outer circle are 28 squares that represent the nakshatras. This mandala with its border is the place where the motions of the sun and the moon and the planets are reconciled. It is the Vastu in which the decrepit, old Chyavana of the Ṛgveda 1.116.10 asks his sons to put him down so that he would become young again. Chyavana is the moon and Sukanya, whom he desires, is the sun.

In the basic Vedic scheme, the circle represents the earth and the square represents the heavens or the deity. But the altar or the temple, as a representation of the dynamism of the universe, requires a breaking of the symmetry of the square. As seen clearly in the agnichayana and other altar constructions, this is done in a variety of ways. Although the main altar might be square or its derivative, the overall sacred area is taken to be a departure from this shape. In particular, the temples to the goddess are drawn on a rectangular plan. In Śiva or Viṣṇu temples, which are square, change is represented by a play of diagonal lines. These

diagonals are essentially kinetic and are therefore representative of movement and stress. They embody the time-factor in a composition.

The Hindu temple, as a conception of the astronomical frame of the universe, serves the same purpose as the Vedic altar, which reconciled the motions of the sun and the moon. The progressive complexity of the classical temple was inevitable given an attempt to bring in the cycles of the planets and other ideas of the yugas into the scheme. There was also further complexity related to the expansion of the tattvas within the temple. For example, in Shaivite temples we see the unmanifest (Śivalinga) expand into the intermediate state of manifest-unmanifest (SadaŚiva), and finally into manifest (Mahesha).

The Ashtadhyayi of Panini (5th century BC) mentions images. Ordinary images were called *pratikriti* and the images for worship were called *archa*. Amongst other things we are told that a toy horse is called *ashvaka*. (This means that the queen who lay down with the *ashvaka* in the Ashvamedha did not sleep with the dead horse.) Deity images for sale were called Śivaka etc., but an *archa* of Śiva was just called Śiva. Patanjali mentions Śiva and Skanda deities. There is also mention of the worship of Vasudeva (Krishna). We are also told that some images could be moved and some were immoveable. Panini also says that an *archa* was not to be sold and that there were people (priests) who obtained their livelihood by taking care of it. They also mention temples that were called *prāsādas*.

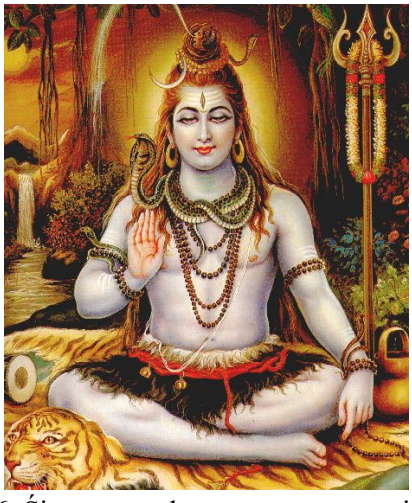

Figure 6. Śiva, a popular contemporary print

Complementing the tradition of the Vedic ritual was that of the *munis* and yogis who lived in caves and performed austerities. From this tradition arose the vihara, where the priests lived. The chaitya hall that also housed the stupa may be seen as a development out of the agnichayana tradition where within the brick structure of the altar was buried the rukma and the golden man.

The gods are the entities that hold up the inner sky of the mind. There is the single Brahman or Purusha, interpenetrating and transcending the inner and the outer universes. But the framework of the inner sky is held up by a variety of gods. The physical nature, governed

by laws, is the Goddess or Shakti. If Brahma is the deity of the astral world, Śiva is that of the physical world, and Viṣṇu that of the causal or the moral world. They each have a consort: Brahma's is Sarasvati, the goddess of learning and the arts; Śiva's is Parvati, the goddess of power, energy, and intuition; Viṣṇu's is Lakshmi, the goddess of good fortune.

The gods themselves are interconnected. Brahma's origin is from the lotus in Viṣṇu's navel. Śiva is the god who subsumes all oppositions. He is the celibate, divine yogi, who is also the perfect husband to Parvati. He brings the world to an end by his dance, but he also creates the world. He is the heart of consciousness, the lord of all beings, the divine dancer. As Ardhanarishvara, he is half Shakti; as Harihara, he is half ṣ.

Viṣṇu is the all-pervader, the primal person, without beginning or end. He is also known as Narayana, with his abode in the waters. He is Hari, the golden-garbed one (like the Sun), and his mount is Garuda, the eagle. During the periods in between dissolution and creation, he sleeps on the cosmic serpent Ananta (the endless). He wields in one of his hands the discus, Sudarshana, which represents time. His consort, Lakshmi, appeared out of the Churning of the Ocean. Periodically, he descends to earth as an avatara to battle evil. Two of the most popular of these avataras are Rama and Krishna.

CHURNING OF THE OCEAN

If extraordinary experience is an epiphany, it comes at the end of long preparation. In myth, we speak of the struggle between the *asuras* (demons) and the *devas* (gods), but this struggle also occurs within the individual between his materialistic and acquisitive tendencies that are demonic, and those of sacrifice, compassion, and understanding that are divine. This struggle is described as the churning of the ocean by the gods and the demons as in Figure 7. On the axis rests the Goddess, who represents Nature. Note that the demons are shown with animal faces since they represent our animal selves.

Figure 7: The churning of the ocean

Our body sense is much stronger than the sense of spirit. It is for this reason the asuras are generally much stronger than the gods. The story goes that the gods have been defeated

and they are dejected. At some point they go to Viṣṇu for help and he suggests that they should assist the asuras in the churning of the ocean of milk, out of which will appear the nectar of immortality that would help them subdue the asuras.

The gods and the demons got together and started churning the ocean with the Mount Mandara as the axis and the snake Vasuki as the rope. The gods were at Vasuki's tail while the demons were at his head. Viṣṇu appeared as a tortoise to support the revolving mountain. As the churning went on, many gifts appeared including the moon which Śiva decided to use as an ornament on his head. Next came Dhanvantari, carrying a jar full of nectar. Next arose Lakshmi, with her attendant elephants of the four quarters sitting on a lotus, a gift of the ocean. She went straight to Viṣṇu.

The demons were dismayed that Lakshmi had not come to them, and they stole the jar with the nectar that was in Dhanvantari's hands. But before they could drink it, Viṣṇu created an illusion of the most beautiful woman, Mohini, and they were so bewitched by her that they did not notice that she took the cup from their hands and gave them to the gods to drink. By the time they knew what had happened the gods had become immortal. The demons drew their weapons and attacked but it was useless. The gods once again became rulers of the three worlds.

Figure 8. Lakshmi (Kamala) emerging from the ocean

The asuric individual is doomed for he gets distracted by the illusory Mohini, whereas one who has higher ideals finds immortality and fame (Lakshmi).

KRISHNA'S DANCE

Krishna's pranks and the love that the cowgirls (gopis) have for him is the frame for much of poetry, dance, and painting in India. As avatara of Viṣṇu, he is the narrator of the Vedic wisdom in the great dialogue of the Bhagavad Gita. His cowherd stories are a take-off on his other name Gopala, which means the protector of the world as well as cowherd, for the root

gauh means both earth and cow.

The story of the love of the gopis is the story of each devotee for God. Krishna performs the *rasa-lila*, a dance, where mysteriously he is able to simultaneously dance with all the different gopis, which represents, no doubt, the mystery that the same One is able to inhabit the many.

Figure 9: Krishna, the divine flute player

Krishna, the flute player, is the spirit that inhabits each one of us. The flute is the body, and the melody is the unfolding of our individual lives. The love of Radha for Krishna can never be fulfilled, since the individual is forever doomed to stay apart from the divine in ordinary experience.

In the Mahabharata, Dhritarashtra is the ego, Vidura is discriminating intelligence, the Kauravas are the physical desires, Krishna is the transcending atman, Arjuna is the empirical atman; the higher faculties are the Pandavas, and the lower faculties are the Kauravas. The characters of the epics and the Puranas do not only act in the outer world; they play out our own private battles.

In the Ramayana, Sita is the intuition who has been abducted by the demon within, who must be set free by Rama, the inner sun. The demon, representing the urge to dominate and possess, has ten heads that represent the sense and action organs of the body. In the struggle between the the asuras and the gods, Hanuman, representing the human mind that has devotion, provides critical assistance.

Figure 10. Harihara: Viṣṇu and Śiva as one

Although Viṣṇu and Śiva make their appearance generally in different situations since their centrality is in different domains, they are also visualized in a unity, as Harihara (Figure 10).

The Indian approach to reality is to seek a harmony that balances materiality with the spirit. It is this harmony that is the main goal of the artistic creation, and we see it expressed not only in the sacred arts, but also in music and dance.

INDIAN AESTHETIC IN AN AGE OF WAR

We live in an age of war fueled by conflicting visions of reality. The mainstream cultural view is of materialism in which consciousness is an emergent process and we are primarily nothing but our bodies. Perhaps because it belittles the spirit, it is leaving many young with a sense of hopelessness. If there in nothing transcendent about life, then life may not be worth living. While some are choosing drugs or hedonism, others are rejecting rationality and joining cults. Religious leaders are stepping in with their own recipes to save the world from a soul-less hell. But their conceptions contradict each other, and although they rightly critique the materialistic paradigm for its disconnect with the spirit, they themselves remain focused on the body when they speak of everlasting life in paradise.

Because of the mechanization of life and the expectations raised by images with which we are bombarded by the media, many are choosing not to have a family, leading to a demographic crisis in the developed world at a time when the post-industrial service economy needs more workers and consumers, requiring vast numbers of immigrants from poorer countries. These are some of the elements leading to a clash of civilizations.

The Indian way offers a different perspective. Indian cosmology is not in conflict with science, although it does speak of the domain of spirit that lies beyond language and rational science. It makes claims regarding the nature of consciousness and transcendent states of awareness that are so extraordinary that if they should be validated by science, they would change the way we conceive of reality.

Our collective history in recent decades has tilted too much to material prosperity. The Indian way is not to reject the body, but to find a harmony between body and soul. To deal with the inevitable march of the machine and the dangers of totalitarianism of one sort or another, it provides intimations of other layers of being that lead to compassion and self-control. It opens up new vistas that shift the focus from being to becoming.

The Puranas have a charming story about how the gods came to become invincible, even though they started out as the weaker party. Shukra, the priest to the asuras, discovered, through science, the secret of reviving persons who had been killed in battle, and with this knowledge the asuras were able to subdue the gods. Brihaspati, who is the priest to the gods, recruited his son, Kacha, for obtaining this knowledge. Kacha presented himself to Shukra asking to be taken in as student. Even though he sensed danger in this, Shukra was helpless because one cannot turn away anyone who is seeking instruction.

Before long, Shukra's daughter Devayani fell in love with Kacha. The asuras were alarmed and they killed him on two occasions, but on his daughter's pleadings Shukra revived him. The third time the asuras not only killed him, but ground his body into powder and mixed it with the wine that they offered to Shukra. When Devayani found that Kacha was missing, she pleaded with her father for help and with his powers he found what had really happened. But t his time he could not just revive Kacha within his belly because that would cause his own death. He had to first teach him what the secret of restoring life was so that when revived, he would bring back the dead Shukra to life. This done, Kacha returned with the secret knowledge to the gods, who again became ascendant.

The coming together of spiritual India and mechanical modernity is like the coming together of Kacha and Shukra that can only be good for all mankind. With wisdom, it should be possible for people, irrespective of their cultural and social background, to live together with compassion and harmony in pursuit of a way of life that values freedom and personal creativity.

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28
Pāṇini and Bharata on Grammar and Art*

I

What could Pāṇini, perhaps the greatest grammarian of all time, have to do with Bharata Muni and his theories of art, drama and music? But speaking of grammar in the same breath as art is not as incongruous as one thinks when it is noted that both language and creations of art are governed by rules and conventions. The challenge in each is to express meaning and feeling in new creative ways, and both Pāṇini and Bharata indicate that at the basis of their productions lies the universal which is, therefore, a means to the knowledge of the self.

Pāṇini's grammar, the Aṣṭādhyāyī, described in nearly 4,000 sūtras the rules to generate all Sanskrit sentences and he collected roots in the dhātupāṭha and primitive nominal stems in the gaṇapāṭha. The Aṣṭādhyāyī is a wonderful resource for the culture and history of his times and it mentions the Naṭasūtra of Śilālin, which was the canonical text on drama in his times.

Pāṇini, by the very beauty, complexity and exhaustiveness of his rules, presaged similar efforts at complete classification in the fields of art and architecture. In this he was following an old model, in which the central results of a science are expressed in terms of sūtras, which in turn require vṛtti (turning the sutras into fully worded paraphrase) and bhāṣya (commentary) for complete explanation. Before Pāṇini's time this was already in place for the six great darśanas of Indian philosophy with their corresponding sutra texts.

Bharata Muni's Nāṭyaśāstra (sometimes called the fifth Veda), which appeared not too long after Pāṇini, classified the diverse arts that are embodied in the classical Indian concept of the drama, including dance, music, poetics, and general aesthetics. Later, the Bṛhatsaṃhitā of Varāhamihira (505-587 CE) and the Viṣṇudharmottara Purāṇa of the 4th century CE [1] describe canonical conventions of architecture, iconography, and painting.

Behind the rules of grammar was the idea clearly expressed in the Muṇḍaka Upaniṣad that all linguistic thought or representation can only hope to approximate reality which, in its deepest levels is transcendent (*parā*). The success of the poet and the artist owes not to the canonical rules and conventions of the medium (surface structure) but rather to the inexpressible intuition behind the conception (deep structure) [2].

The artist strives to represent the divinity or communicate its spirit through the artistic creation, so that the aesthete might get connected to his or her own divinity within them. The beginnings of this in the Vedic ritual were in terms of representing the cosmos in the fire altar which, later, became the model for the temple [3], fine arts and music [4]. Pāṇini's work falls quite within the framework of the Vedic tradition for he took the earlier Pratiśākhya rules on converting the word-for-word recitation of the Veda into a continuous recitation and created

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an abstract grammar of unsurpassed power.

In the Viṣṇudharmottara Purāṇa, the sage Mārkaṇḍeya says that although divinity is formless, worship and meditation are possible only when it is endowed with form. Therefore, the artist observes nature carefully and molds that inspiration using the conventions that he has internalized in the realm of his imagination.

The model for the creative sciences in India is the churning of the ocean (*samudramanthana*) that occurs within the heart of the artist. This is a dance between mechanicity and freedom, represented respectively by the demons and the gods, out of which new vision and insight.

The creative process depends on rules and precepts but the artist must reach for a deeper understanding that helps him recognize the authentic and the meaningful, just as the poet cannot depend on the rules of grammar alone to find words that communicate felt experience. The driving force must thus be the transcendent self which informs the mechanistic mind.

II

Dākṣīputra Pāṇini was born in Śalātura in northwest India, north of the confluence of the Sindhu and the Kabul rivers. According to tradition, he became a friend of the king Mahānanda of Magadha (5th century BCE). The Kathā-sarit-sāgara of Somadeva (11th century) mentions that Pāṇini's teacher was Varṣa and his rival was Kātyāyana. The Aṣṭādhyāyī appears to supersede an earlier Aindra grammar. Xuanzang (Hieun Tsang) in the 7th century visited Śalātura and found that the grammatical tradition was continued there and that Pāṇini had been honored with a statue [5],[6].

Pāṇini's grammar along with its word-lists, presents invaluable incidental information about life and society in the 5th century BCE India. It provides us names of cities, towns, villages and cultural and political entities called Janapadas, details regarding social life, economic conditions, education and learning, religion, and political conditions.

The Janapada states had different kinds of government. Some Janapadas were republics, others were monarchies. We learn that the king did not have absolute power and he shared authority with his minister. This balancing of the powers created an environment that was conducive for questioning out of which emerged the many sciences that have come down to us.

Pāṇini’s references shed important light on the way religion was practiced. We find that images were used to represent deities in temples and open shrines. There were images in the possession of the custodian of shrines. The Mahābhāṣya, the second century BCE commentary on Pāṇini’s grammar describes temples of Dhanapati, Rāma, Kṛṣṇa, Śiva, and Viṣṇu.

Pāṇini is aware of the Vedic literature and the Upaniṣads. He also knows the Mahābhārata. Pāṇini's work is thus invaluable in the dating of the texts of the Vedic period. Pāṇini describes coins that came prior to the period of Kauṭilya's Arthaśāstra (4th century BCE). Pāṇini appears to have traveled to Pātaliputra to participate in a great annual meeting

of scholars.

III

What the Aṣṭādhyāyī is to language, the Nāṭyaśāstra is to the artist and the musician [7]. The structure of Indian classical music and dance was added to by Mataṅga Muni's Bṛhaddeśi (about 600 CE), Abhinavagupta's Abhinavabhāratī and Śārṅgadeva's Sangīta Ratnākara (13th century). This connection with the tradition has continued in the Hindustani Saṅgīta Paddhati by Viṣṇu Nārāyaṇa Bhāṭkhaṇḍe from the early 20th century.

Bharata explains the relationship between the *bhāva*s, the emotions evoked in the spectators, and the *rasa*, essence of the performance or the work of art. He says that the artist should be conscious of the bhāva and the rasa that is being sought to be established. The word rasa itself means "juice" and it is seen as emerging from the interplay of vibhāva (stimulus that may be a word or a gesture), anubhāva (reaction) and vyabhicārī bhāva (fleeting or transitory emotion). A performance that is technically correct but has no emotion would be said to be wanting in rasa. According to Abhinavagupta, rasa is a universal mental state and the highest purpose of all creative arts is to help the connoisseur reach such a state, for the arts are the aesthetic means to knowing the self.

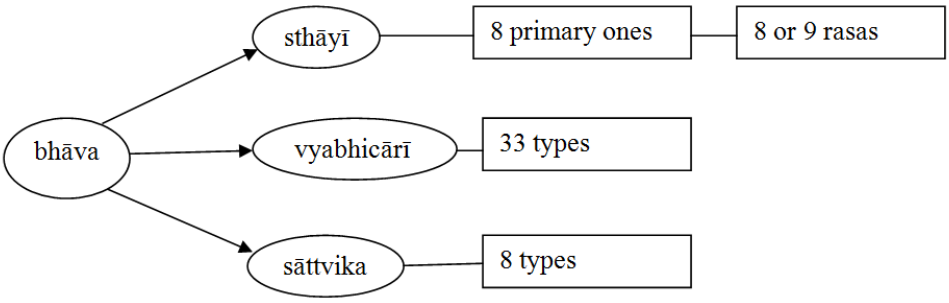
Bharata explains rasa by giving the parallel of the combination of various condiments, each having its own taste, which creates a unique taste that lingers. The corresponding combination in drama leads to a feeling (sthāyībhāva) that is the nāṭyarasa. In both these cases, the subject, whose mind reflects cultural and personal experience, is central to the appreciation of the creation.

The eight sthāyibhāvas are rati (love), hāsa (mirth), krodha (anger), śoka (grief), utsāha (heroism), bhaya (fear), jugupsā (disgust), and vismaya (wonder). Corresponding to these are the eight *rasas* of the Nāṭyaśāstra that form four pairs:

i. *śṛngāra*, love, devotion. Color: dark hue.
ii. hāsya, laughter, mirth. Color: white.
iii. *raudra*, fury, anger. Color: red.
iv. *kāruṇya*, compassion, sadness. Color: dove colored.
v. *vīra*, heroism, courage. Color: yellowish.
vi. *bhayānaka*, fear, terror. Color: dark.
vii. *bībhatsa*, repulsion, aversion. Color: blue
viii. *adbhuta*, wonder, astonishment. Color: yellow

The deities associated with these are Viṣṇu, Pramatha, Rudra, Yama, Indra, Kāla, Mahākala, and Brahmā, respectively. Later, the sages accepted a ninth rasa *śānta*, peace or tranquility, with the color of white and Viṣṇu as deity, and the expression *navarasa* (the nine *rasas*) became popular. Nāṭya is a sharpened representation of life wherein the various emotions are dramatically enhanced so that the spectator gains the flavor of the portrayed

pleasure and pain taking him to the source of this within himself.



Bhāvas and rasas

There are three types of bhāva, namely sthāyī (eight types), vyabhicārī (thirty-three), and sattvika (eight), for a total of forty-nine. The eight sthāyī bhavas are the bases of the eight rasas.

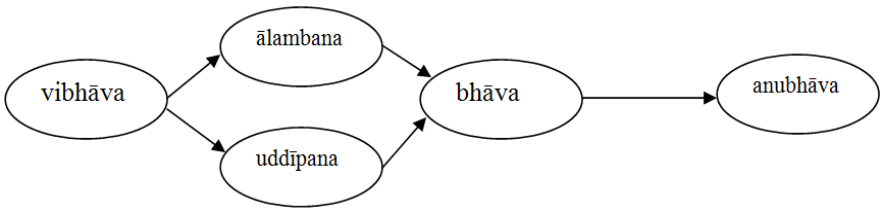
The vyabhicārī bhāvas are:

1. *nirveda* (depression, caused by abuse, censure, and so on)	2. *glāni* (languor, result of hurt, emptiness, illness, and so on)	3. *śaṅkā* (suspicion)
4. *asūyā* (jealousy)	5. *mada* (intoxication)	6. *śrama* (fatigue)
7. *ālasya* (laziness)	8. *dainya* (misery)	9. *cintā* (anxiety)
10. *moha* (fainting, caused by ill luck, calamity)	11. *smṛti* (memory)	12. *dhṛti* (fortitude)
13. *vrīḍā* (sense of shame)	14. *capalatā* (nervousness)	15. *harṣa* (joy)
16. *āvega* (agitation or excitement)	17. *jaḍatā* (slothfulness)	18. *garva* (pride)
19. *viṣāda* (sorrow)	20. *autsukya* (unease arising from remembrance of a dear one or a beautiful place)	21. *nidrā* (sleepiness)
22. *apasmāra* (forgetfulness)	23. *supta* (overcome by sleep)	24. *vibodha* (awakening)
25. *amarṣa* (intolerance)	26. *avahittham* (dissimulation)	27. *ugratā* (fierceness)
28. *mati* (understanding)	29. *vyādhai* (illness)	30. *unmāda* (insanity)

31. *maraṇam* (death)	32. *trāsa* (dread)	33. *vitarka* (argumentation)

The sāttvika bhāvas are the physical manifestation of genuine emotion. They are:

a. *stambha* (stupefaction),
b. *sveda* (perspiration),
c. *romāñca* (thrill),
d. *svarabheda* (voice change),
e. *vepathu* (trembling),
f. *vaivarṇya* (facial color change),
g. *aśru* (tears),
h. *pralaya* (swoon, fainting).



From stimulus to emotion and subsequent reaction

Vibhāva as the cause has two fundamental components: the ālambana vibhāva which is the basic stimulant and the uddīpana vibhāva which is the enhancing stimulant related to the environment and the context. If the heroine is the ālambana vibhāva, the location, like a garden, is the uddīpana vibhāva.

Abhinavagupta asks the question whether nāṭya is representation of reality (tattva) or its likeness (sadṛṣya) as in the case of a twin, or mere error (bhrānti) as in the case of silver being taken as a piece of mother-of-pearl, or superimposition (āropa), or as replica (*pratikṛti*) as in the case of a painting of a model, and so on. He asserts that nāṭya is neither of these for each of these lacks transcendence (asādhāraṇatā) without which there cannot be rasa.

The aesthetic experience is a doorway to the innate dispositions of the self for in that moment the connoisseur has become more than just his own self. In the contemplation of characters depicted in the work of art, or in the absorption in an abstract composition, the mind feels the breath of the universal spirit.

V

Let me now briefly speak of the impact of these ideas. Pāṇini's work, in particular, and Sanskrit grammar, in general, showed the way to the development of modern linguistics through the efforts of scholars such as Franz Bopp, Ferdinand de Saussure, Leonard Bloomfield, and Roman Jakobson. Bopp was a pioneering scholar of the comparative grammars of Sanskrit and other Indo-European languages. Ferdinand de Saussure wrote his

Ph.D. on *De l'emploi du génitif absolu en Sanscrit* (1880) and lectured on Sanskrit in Paris and Geneva. In his most influential work, Course in General Linguistics (*Cours de linguistique générale*), that was published posthumously (1916), he took the idea of the use of formal rules of Sanskrit grammar and applied them to general linguistic phenomena. Bloomfield, having studied Pāṇini, contributed much to structural linguistics, applying these ideas not only to Indo-European historical linguistics but also to Austronesian and native American languages.

Roman Jakobson, who died in 1962, contributed to the development of the structural analysis of language, and eventually these ideas were applied to disciplines beyond linguistics, such as anthropology and literary theory. Modern linguistics seeks not only to determine the type of a language but also its specific characteristics and linguistic universals is the study of the general features of languages in the world.

The structure of Pāṇini's grammar contains a meta-language, meta-rules, and other technical devices that make this system effectively equivalent to the most powerful computing machine. Although it didn't directly contribute to the development of computer languages, it influenced linguistics and mathematical logic which, in turn, gave birth to computer science.

The works of Pāṇini and Bharata Muni also presage the modern field of semiotics which is the study of signs and symbols as a significant part of communications. Bharata's Nātyaśāstra has much material on acting, signs, gestures, and posture each one of which communicates its own specific meaning to the spectator.

The search for universal laws of grammar underlying the diversity of languages is ultimately an exploration of the very nature of the human mind. The other side to this grammar is the idea that a formal system cannot describe reality completely since it leaves out the self. As human society evolves, signs and symbols in use lose their original meaning, manners change, and fashions come and go.

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29
The Great Goddess Lalitā and the Śrī Cakra*

INTRODUCTION

Here we speak of the great Goddess Lalitā, who is also known as Tripurasundarī, Mahārājñī and Rājarājeśvarī amongst other names. She is the presiding deity of the most esoteric yogic practices associated with the Śrī Cakra (also called Śrī Yantra) that are collectively called Śrī Vidyā.

According to the Vedic view, reality, which is unitary at the transcendental level, is projected into experience that is characterized by duality and paradox. We thus have duality associated with body and consciousness, being and becoming, greed and altruism, fate and freedom. The Gods bridge such duality in the field of imagination and also collectively in society (Kak, 2002): Viṣṇu is the deity of moral law, whereas Śiva is Universal Consciousness. Conversely, the projection into processes of time and change is through the agency of the Goddess. Consciousness (*Puruṣa*) and Nature (*Prakṛti*) are opposite sides of the same coin.

The mystery of reality may be seen through the perspectives of language (because at its deepest level it embodies structures of consciousness) and logic (*nyāya*), physical categories (*vaiśeṣika*), creation at the personal or the psychological level (*sāṅkhya*), synthesis of experience (*yoga*), structures of tradition (*mīmāṃsā*), and cosmology (*vedānta*). These are the six *darśanas* of Indian philosophy. Each of these ways of seeing takes us to different kinds of paradox that prepares us for the intuitive leap to the next insight in the ladder of understanding (Kak, 2007).

Sages have argued that the yogic journey turned inwards, a practice that is popularly called Tantra, is the quickest way to reaching the top of the ladder and become free. If Yoga is viewed as control of the mind (*cittavṛtti nirodhaḥ*), meditation (*dhyāna*, attention), harmony of body and spirit (*samādhi*), or the way of freedom (*svātantrya*), how is one to find any of these when one is continuously distracted by desires? Where is freedom if one is weighed down by the burden of one's past with its guilt and regret?

But each one of us is capable of one-pointed concentration if our life depends on that moment. This is the concentration of the warrior on the chaotic battlefield. The warrior observes everything, even if only by the corner of his eye. Protected by the shield of his discipline, he is able to ward off the assaults on his being. Truth, compassion, energy, fearlessness, and fortitude (*yama* and *niyama*) are his shield; he is never without protection and, therefore, he cannot be vanquished. He lives fully in the moment.

One doesn't have to be on the battlefield to live like a warrior: the individual who lives the life with this attitude is a yogi. But no one is born a warrior, and how does one

* Brahmavidyā: The Adyar Library Bulletin, vol. 72-73, pp. 155-172, 2008-2009

prepare oneself to be one in view of the suffering that exists in life and the fear of death? Śrī Vidyā provides this preparation and it endows us with strength and unparalleled intuition. It leads to the heart of beauty, desire, and power, making it possible for us to separate our being from elemental impulses.

As our ordinary conception of who we are is determined by name and form (*nāmarūpa*), this journey requires challenging our most basic beliefs related to our personal and social selves. One needs to travel to the deepest layers of our being wherein spring our desires, some of which are primal and others that are shaped by culture and experience. Since name and form belong to the realm of time and change, this path is that of the Goddess. This path may be quick, but it is filled with danger since it involves deconstructing one's self and arriving at a new synthesis. Our inner world is like a jungle with its attendant beasts and many kinds of mortal dangers. Just as one should not enter a land with unknown topography, deserts, and rivers, without being armed and equipped, one should not try to enter one's inner landscape without being prepared. Such a journey needs guidance from someone who has been there before and it should not be undertaken by one who is not ready for this adventure. This way of the warrior is not for the faint of heart.

We explore first the question of the antiquity of the Śrī Cakra by showing that it figures in a very early text, the Śvetāśvatara Upaniṣad (SU). The deity of the Śri Cakra is known to us from the Brahmāṇḍa Purāṇa as Lalitā Tripurasundarī, the playful transcendent beauty of the three cities. The meaning of the Cakra and its nine circuits will be explained. The connections of the tradition of Śri Vidyā with the ritual of Navarātri will be described.

ŚVETĀŚVATARA'S YANTRA

The sage Śvetāśvatara, who belonged to the late Vedic period, asks in his Upaniṣad whether time (*kāla*) or nature (*svabhāva*), or necessity (*niyati*) or chance (*yādṛcchā*), or *Puruṣa* is the primary cause of this reality. He answers in a riddle that goes:

tamekanemi trivṛtaṃ ṣoḍaśāntaṃ
śatārdhāraṃ viṃśatipratyarābhiḥ
aṣṭakaiḥ ṣaḍbhirviśvarūpaikapāśaṃ
trimārgabhedaṃ dvinimittaikamoham .1.4

Who (like a wheel) has one felly with three tires, sixteen ends,
fifty spokes, twenty counter-spokes,
six sets of eight, one universal rope,
with three paths and illusion arising from two views. SU 1.4

This looks like the description of a Yantra, but we don't have enough information on how to proceed to draw it. The text doesn't also explain what knowledge is symbolically expressed in this Yantra. An interpretation of these numbers as different categories of

Sāṅkhya was provided by Śaṅkara (788-820) although he did not specifically address its graphical design.

We argue that this describes the Śrī Cakra. This might appear surprising at first because the Śvetāśvatara Upaniṣad extols Rudra-Śiva and the Śrī Cakra is associated with the Goddess. But since Śiva does reside at the innermost point (*bindu*) of the Cakra along with the Goddess, it is not inconsistent with the focus of the Śvetāśvatara Upaniṣad. Furthermore, SU 4.9 proclaims: *māyāṃ tu prakṛti vidyānmāyinaṃ tu maheśvaram*, consider Nature to be magical (*māyā*) and the Great Lord (*Maheśvara*) to be the one who has cast the spell (*māyin*). The Goddess is another name by which Nature is known, therefore the mystery of the Lord in the launching of the Universe can only be known through the Goddess. The identification of the Śrī Cakra in SU goes against the scholarly view that the Śrī Cakra is a post-major-Upaniṣadic innovation, and, if accepted, this calls for a revision of the history of the development of Tantra.

The *bindu* or dot in the innermost triangle of the Śrī Cakra represents the potential of the non-dual Śiva-Śakti. When this potential separates into *prakāśa* (the *aham* or I-consciousness, Śiva) and *vimarśa* (the *idam* or this-consciousness, Śakti) it is embodied into *nāda, kalā* and *bindu*. *Nāda* is the primal, unexpressed sound (interpreted by human ear as *oṃkāra*) and *kalā* is the "kāma kalā," the desire to create, which the Vedas tell us is the desire "May I be many" (Chāndogya Up. 6.2.1.3). *Bindu*, as the potential universe ready to separate into various categories is Mahātripurasundarī. Śiva as *Prakāśa* (luminosity or consciousness) has realized himself as "I am", through her, the *Vimarśa Śakti* (Nature as the reflector).

It must be stated that within the Yogic tradition, it has always been believed that Tantra is a part of the Vedas itself. In the Devī Sūkta (Ṛgveda 10.125), the Goddess describes herself as supreme. In the Śrī Sūkta of the Ṛgvedic hymns (appendices), the goddess Śrī is associated with prosperity, wealth, and fortune, and she is spoken of as deriving joy from trumpeting elephants. The Śrī Sūkta, addressed to Jātavedas of Fire, was invoked at the fire ritual. In Kauṭilya's Arthaśāstra (14.117.1) there is reference to the goddess being invoked for the protection of a fort. In the Bṛhadāraṇyaka Upaniṣad 7.4 there is a reference to the goddess Vāc.

The Vedic triads, together with the dyadic male and female components, enlarge through expansion (*prapañca*) so the universe is a projection (*vimarśa*) of the Absolute's self-illumination (*prakāśa*).

The supreme deity in the form of Śakti (*parāśakti*), Śrī as the great goddess (*mahādevī*) is one of the aspects of Lalitā Tripurasundarī. Lalitā Tripurasundarī has three manifestations: *sthūla,* or descriptive as image; *sūkṣma,* or subtle as mantra; and *parā,* or transcendent as *yantra* or *cakra*. Lalitā Tripurasundarī is also called Rājarājeśvarī or just Śrīdevī. Those who see the three representations as interrelated are called the followers of the *kaula* tradition, as has been the case with the Kashmiris.

In the South, the *Tirumantiram* (*Śrīmantra* in Sanskrit) of the seventh century *siddha* Tirumular knows Śrīvidyā. In the *Lalitāsahasranāma*, Lalitā is described in terms similar to those of Durgā. Lalitā is worshiped as the srividyā mantra and as the Śri Yantra.

he Śrīvidyā mantra is known in three forms: *kādi* (starting with *ka*), *hādi* (starting with *ha*), and *sādi* associated with Śri Manmatha, Lopāmudrā, and Durvāsā respectively. The mantra is divided into three parts, which represent three sections (*kūṭa* or *khaṇḍa*) of the image of the Goddess: *vāgbhavakūṭa, kāmarājakūṭa,* and *śaktikūṭa*.

The *kādividyā* of Śri Manmatha:

ka e ī la hrīṃ (vāgbhavakūṭa)
ha sa ka ha la hrīṃ (kāmarājakūṭa)
sa ka la hrīṃ (śaktikūṭa)

The *hādividyā* of Lopāmudrā:

ha sa ka la hrīṃ (vāgbhavakūṭa)
ha sa ja ha la hrīṃ (kāmarājakūṭa)
sa ka la hrīṃ (śaktikūṭa)

The *sādividyā* of Durvāsā:

sa e ī la hrīṃ (vāgbhavakūṭa)
sa ha ka ha la hrīṃ (kāmarājakūṭa)
sa ka la hrīṃ (śaktikūṭa)

The 18th century scholar Bhāskarāya maintained that the Śrīvidyā mantra is meant in Rgveda 5.47.4 where it is said: *catvāra īṃ bibharti kṣemayantaḥ*, "that with four *īṃ*s confers benefit". The *kādi* mantra (*pañcadaśākṣarī*) has four long ī vowels. According to some, the 16-syllable mantra (*ṣoḍaśākṣarī*) is obtained by adding the seed-syllable (*bījākṣara*) *śrīṃ* to the 15-syllable mantra.

The Śri Vidyā mantra is viewed as 37 syllables, representing the 36 *tattvas* of reality of Śaivism and the 37th transcendent Parāśiva state. These are divided into 11 for the *vāgbhavakūṭa*, 15 for the *kāmarājakūṭa*, and 11 for the *śaktikūṭa* (Vrajavallabhadvivedaḥ, 1988).

THE ŚRI CAKRA AND LALITĀ TRIPURASUNDARI

The three cities in the name of Lalitā Tripurasundarī are that of the body, the mind, and the spirit, or that of will (*icchā*), knowledge (*jñāna*) and action (*kriyā*). They may also be seen as the knower, the means of knowledge, and the object of knowledge; the three gunas of *sattva*,

rajas and *tamas*; *agni* (fire), *sūrya* (sun) and *candra* (moon); *sṛṣṭi* (creation), *sthiti* (preservation) and *laya* (dissolution); intellect, feelings, and sensation; subject (*mātā*), instrument (*māna*), and object (*meya*) of all things; waking (*jāgrat*), dreaming (*svapna*) and dreamless sleep (*suṣupti*) states; as *ātma* (individual self), *antarātma* (inner being) and *paramātma* (supreme self) and also as past, present and future.

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. Their union is harmony or *samarasa*.

Śaṅkara (788-820) spoke of the Śri Cakra in the *Saundaryalaharī* (SL) (Subramaniam, 1977). In SL11, the Śri Cakra is described in terms of its 4 *Śrikaṇṭha* (upward pointing) and 5 *Śivayuvatī* (downward pointing) triangles, which create its 43 triangles. If we look Śrī Cakra's structure as consisting of three basic triangles, then within each triangle are lower hierarchical levels of two other triangles, of alternating polarity. The 42 outer triangles are arranged in four circles around the middle triangle, with counts of 8, 10, 10, and 14 in the four arrays. The Śrī Cakra is also associated with the cakras of the yogi's body. According to SL 14:

> *Fifty-six for earth (mūlādhāra); for water fifty-two (maṇi-pūraka),*
> *sixty-two for fire (svādhiṣṭhāna); for air fifty-four (anāhata),*
> *seventy-two for ether (viśuddhi); for mind sixty-four (ājña cakra)*
> *are the rays; even beyond these are your twin feet.*

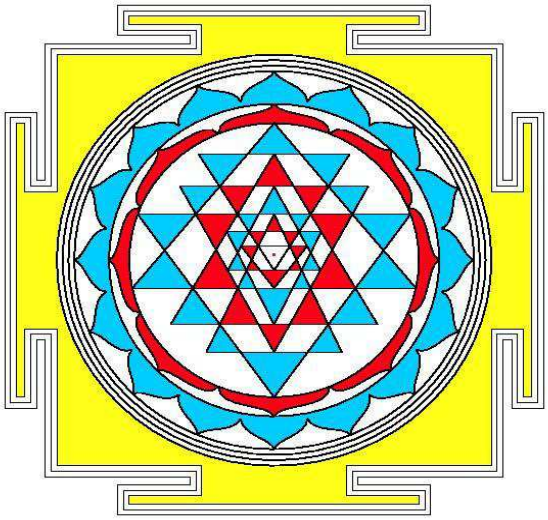
The six *cakras* are classified in *granthis* (knots) of two. The lowest two cakras correspond to 108 rays, the middle two to 116, and highest two to 136 rays. I have argued elsewhere that this provides an explanation for the layout of the great Śiva temple at Prambanan in Indonesia (Kak, 2010)

The Śrī Cakra embodies the tripartite division of the cosmos into earth, atmosphere, and the sun, which is mirrored in the individual by the body, the breath, and the inner lamp of consciousness; it also represents the three parts of the body: neck to head, neck to navel, and navel to the bottom of the trunk. It is within the wheel of time (*kālacakra*), and it is both the human body (microcosm) and the universe (macrocosm). Its middle 43 triangles are surrounded by a circle of 8 petals that, in turn, is surrounded by a 16-petalled circle. At the outermost are 3 lines, which are called the *bhūpura*. They are also categorized into 9 circuits or *āvaraṇas*, where the *bhūpura* is the outermost *āvaraṇa*. These 9 *āvaraṇas* have 108 presiding Devis. In the Śrī Cakra *pūjā* they are systematically worshipped one by one with their names and mantras. The nine circuits symbolically indicate the successive phases in the process of becoming.

The nine cakras are compared in the Tripura Upaniṣad to the nine yogas, namely the eight familiar ones of Patañjali and the additional one of *sahaja.*

Lalitā Tripurasundarī's three śaktis, which are shown in the three corners of the inner triangle, are Bhagamālinī, Vajreśī, and Kāmeśvarī, who are associated with Brahmā, Viṣṇu,

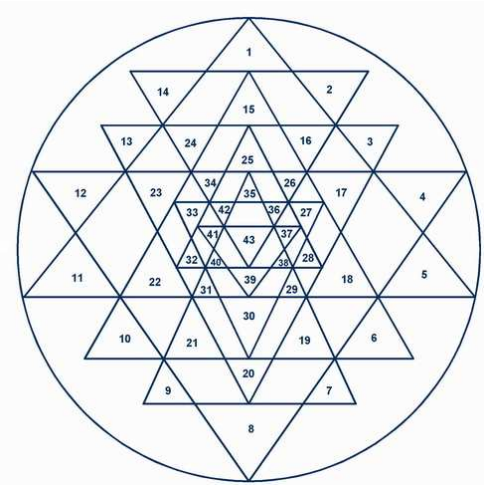
and Rudra. The central *bindu* is where the Goddess is united with Śiva, the Universal Consciousness.



The Śrī Cakra

Cakra pūja or Yantra pūja is the worship of the deity. Devi, the cosmic female force, is the first step of creation. The counterpoint male principle has three emanations: Rudra from the left, Brahmā from the middle, and Viṣṇu from the right. At the centre of the Śri Yantra is *kāmakalā*, which has three *bindus*. One is red, one is white and one is mixed. The red bindu is Kurukulla, the female form; the white *bindu* is Vārāhi the male form; and the mixed *bindu* is the union of Śiva and Śakti.

Lalitā Tripurasundarī



Forty-three triangles of the Śrī Cakra

Looking at the Śrī Cakra from outside in within the circular part of the Yantra, we thus have one felly with 3 tires, 16 ends of the petals in the outer circle, and a total of 50 (8 petals and 42 triangles outside of the central one) "spokes", with 20 triangles in the middle two circuits that may be termed "counter-spokes", a total of six circuits of petals and triangles have either 8 or more than 8 members, the universal rope is the *bhūpura*, the three paths are the paths ruled by *tamas, rajas,* and *sattva* embodied by the three Goddesses in the innermost triangle.

The Śrī Cakra maps the inner sky as one goes from outside to inside; it is also located in the body in terms of the 6 *cakras*. The count of 50 of the Śrī Cakra is mapped to 50 petals of the *cakras* as one goes from the base (*mūlādhāra*) to the *ājña cakra.* The specific number of lotuses is 4, 6, 10, 12, 16, and 2. The *sahasrāra cakra*'s 1000 petals parallel the infinity associated with the innermost triangle of the Śrī Cakra.

Inside the square are three concentric circles, girdles (*mekhalā*). The space between the square and three girdles is the *Trailokyamohana cakra*, or the cakra that enchants the three worlds; at this stage the adept sees himself as his social self completely immersed in the magic of life.

Next are two concentric rings of sixteen and eight lotus petals, respectively. The first of these is *Sarvāśāparipūraka cakra,* which is the cakra that fulfils all desires; the second is the *Sarvasānkṣobhaṇa cakra*, indicating dissolution of apartness and duality.

The fourth cakra, consisting of the fourteen triangles forming the outer rim of the complex interlocking of triangles*,* is the *Sarvasaubhāgyadāyaka*, giver of good fortune, which leads one to spiritual insight and success. The next two cakras are each constructed of ten triangles. Called *Sarvārthasādhaka*, making all means effective, and *Sarvarakṣākara*, protecting the unifying thread in all experience, they indicate stages when inner realization begins to strengthen. The seventh cakra, consisting of eight triangles, is the *Sarvarogahara*, removing all attachment to duality, at which the sādhaka is near deep transformation.

An inverted triangle is the eighth cakra of *Sarvasiddhaprada*, that provides all powers and validation. The last cakra, the *bindu*, is *Sarvānandamaya*, full of bliss. It is the heart of one's self in which one witnesses the union of one's own nature and spirit, Śakti and Śiva.

The ritual includes making ten *mudras* with the fingers, in which the fingers of the right hand represent *prakāśa* and those of the left hand represent *vimarśa*. The joining of the fingers of the two hands in different *mudras* symbolically represents evolution of names and forms. The Śri Yantra and its worship encompass the deepest secrets of Vedic knowledge. Not only does it represent the inner cosmos, which has the framework of infinity and recursion across scale and time and a mirroring of the outer and the inner, the ritual associated with it is the heart of *yajña*.

The Cakra is a representation of Devī in many forms: Lalitā, Kātyāyani, Kāmeśvarī, Kāmākṣī, Durgā, Caṇḍī, Kālī, Ambā, and so on, that is reality (*sat*), mind (*cit*) and bliss (*ānanda*). As Mahāvidyās, Devī has the forms Kālī, Tārā, Tripurasundarī, Bhuvaneśvarī, Chinnamastā, Bhairavī, Dhūmavatī, Bagalāmukhī, Mātaṅgī, and Kamalā (Lakṣmī).

Śārikā Devī (painting by Veer Munshi)

The Śri Yantra ritual infuses the yantra with mantra that represents the union of space and sound. Its closed, concentric circuits (maṇḍalas) correspond to the nine planes of consciousness of the sādhaka. Each plane is a stage on the ascent of one's being toward the Inner Self.

The vowels and consonants of Sanskrit are inscribed in the vertices of the Sri Yantra and also within the body of the practitioner (Abhinavagupta, 2005). In each of the nine circuits (āvaraṇas) specific deities are invoked. The deities are like veils concealing the deeper essence. After the sādhaka has invoked all the devatas in the prescribed manner, he obtains an insight in which all the deities of the plane are fused to become the presiding deity of the circuit.

THE NINE ĀVARANAS

The *bhupura* is the first (outermost) āvaraṇa of the Sri Caktra. These lines have 10, 8, and 10 Devis, respectively. They include the eight Mātṛkā Śaktis, which are the psychological forces that spring out of ego. The second āvaraṇa has 16 petals in which reside16 Devis that rule over different aspects of physical well being. The third āvaraṇa is the 8 petal circle with eight Devis who represent various actions as well as non-action. The first three āvaraṇas represent *sṛṣṭi,* or extension of creation.

The fourth āvaraṇa is the outer set of 14 blue triangles, which represent the 14 worlds and the 14 main Nāḍīs in the human body; the fifth āvaraṇa consists of 10 red triangles; the sixth has the inner 10 red triangles; these three āvaraṇas represent *sthiti*, or preservation. The seventh is the inner 8 green triangles; the eighth is the inner triangle. The three corners of this triangle are: Kāmeśvari, the Rudra Śakti or Pārvati; Vajreśi is the Visnu Śakti, Laksmī; and Bhagamālini is the Brahmā Śakti, or Sarasvatī. The ninth āvarana is the *bindu*, which is the

cosmic union of Śiva and Śakti. The deity, Mahā Tripurasundarī, is the personification of Parā Brahman. These three āvaraṇas represent *samhāra,* or absorption.

The fourth to the eighth āvaranas

Durgā vanquishing Mahiśasura (Orissa, 7th century)

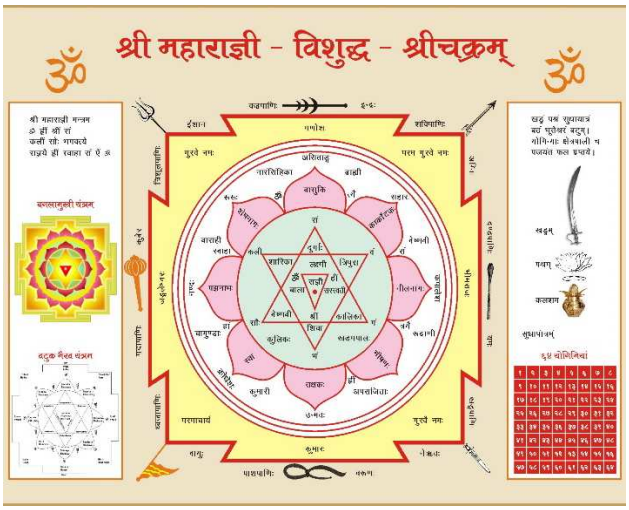
Do the nine sheaths stand up to scientific scrutiny? Modern neuroscience has not yet reached a level where the sheaths covering the innermost sense of self can be examined in the laboratory (Kak, 2004). But it does speak of centers that mediate different aspects of selfhood. The nine sheaths, in the Śri Cakra, are a consequence of the interplay between the realities of various kinds of triads that were mentioned before. To that extent, the nine sheaths are a reasonable way of representing the inner space of our being which is validated by the experience of the sages.

Durga at Prambanan (10th century)

The Devi-Māhātmya presents an account of what Mahākālī, Mahālakṣmī, and Mahāsarasvatī do to bring about the transformation of *prakṛti* from *tamas* to *rajas*, from *rajas*

to *sattva* and from *sattva* to Supreme *Vijaya*, which is mastery in the Absolute. The Navarātri is a form of Śri Cakra pūjā where the nine nights represent the nine āvaraṇas. The first three days are a worship of Mahākālī, Mahālakṣmī, and Mahāsarasvatī; on the subsequent days, their exploits are celebrated. The completion of the sādhanā is the marriage of Śiva and Pārvatī. The process is like overcoming the demonic materiality of one's own self that is represented elsewhere by Rāvaṇa. This victory is celebrated on the tenth day (Vijaya Daśamī) as that of Durgā over Mahiśāsura.

In Kashmir, the goddess Śārikā Devī subsumes in herself all the nine āvaranas, which is why she is shown with nine sets of arms.



A contemporary representation of Śri Cakra for Maharājñī (Kashmir)

CONCLUDING REMARKS

We have seen much overlap between the numbers described in the Śvetāśvatara Upaniṣad and those of the Śrī Yantra. In our opinion the case for the two Yantras being the same is compelling. The conception of the Goddess as the Supreme power out of which all the Gods emerged, encountered in the Durgā Saptaśatī, existed at the time of the Śvetāśvatara Upaniṣad for it is also proclaimed in the Devī Sūkta of the Ṛgveda (10.125). Furthermore, we have evidence of yantric structures in India that go back to about 2000 BC (Kak, 2005) as well as representations of the Goddess killing the buffalo demon from the Harappan period, so we are speaking here of a very ancient tradition.

The Śrī Cakra is an iconic representation of the deepest intuitions of the Vedas. It represents both the recursive structure of reality and also expresses the fact that Nature and Consciousness are interpenetrating (Kak, 2007). It is relatively easy for the conditioned mind to question names and forms (*nāmarūpa*) as compared to turn the gaze of one's inner mind on one's consciousness. It is a journey to the domain of aloneness (*kaivalya*) in which one finds wonderful company and astonishing insights. The Śrī Cakra looks at reality through the

lens of beauty and felt experience. By helping one penetrate the various coverings of one's mind, it takes the seeker to Śiva, the fixed point of one's self.

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Part 6

SCIENCE AND CONSCIOUSESS

30
A Brief History of Indian Science*

INTRODUCTION

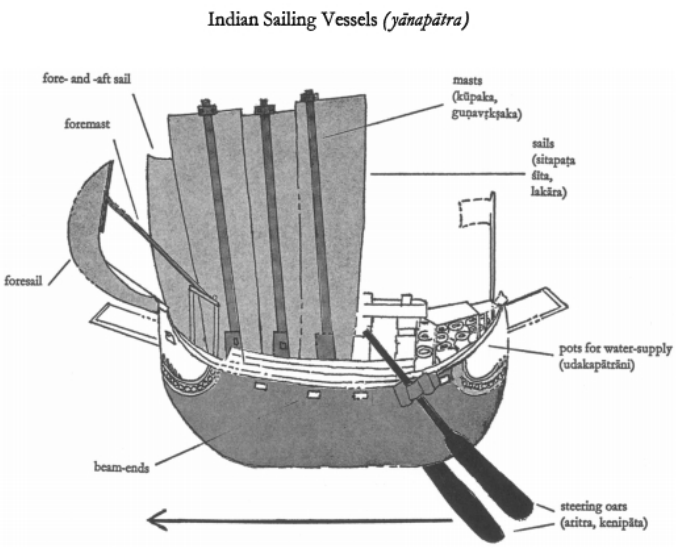
To consider the history of Indian science, one must first know why most educated people know little about it. The reasons go back to the disastrous nature of the British Raj, which it is estimated cost India $45 trillion dollars of wealth, and led to the destruction of native industry and education systems.[1] The literacy rate in India on the British watch declined from an estimated 70% to just 12% with a near-complete loss of memory of its previous condition.[2] Britain also foisted false narratives of history on India. The curricula that were introduced in school and college were not linked to India's own scholarly tradition so much so that Indians came to believe India had no tradition of science.

India was the world's leading nation in science before the Middle Ages. Sa'id al-Andalusi, who, in 1068 in Muslim Spain, wrote Ṭabaqāt al-'Umam (Categories of Nations)[3] to assess the sciences of different nations, says that the sciences, particularly mathematics and astronomy, are most advanced in India (calling it the first nation). Indian technology was flourishing before the arrival of the British. Economists aver that India's share of the world economy in 1800 was nearly 25 percent and by the time the British left it had shrunk to about 2 percent.

Shipbuilding required the most advanced skills in the pre-industrial revolution age, and Abraham Parsons, a British traveler, described India's prowess in this field in 1775 thus: "Ships built at Bombay are not only as strong, but as handsome, are as well finished as ships built in any part of Europe; the timber and plank, of which they are built, so far exceeds any in Europe for durability."[4]

In some ways Indian shipbuilding technology was ahead of the European, for in the assessment by historian Dieter Schlingloff[5]: "The ancient Indian merchant ships differed from the Roman merchant ships in one respect, namely in their multiple masts. While in the entire European area the ships only possessed a single mainsail (and at best a fore-and-aft sail) right up to the late Middle Ages, in India two, and later three sails were common. Of course, the home territory of the Indian seafarers was not an inland sea like the Mediterranean, but the Indian Ocean. Hence they developed a sophisticated system of sails which in number of sails was only matched and surpassed by the explorers' ships of the I5th century."

* Academia.edu (2021)



A three-sail ship shown in Cave 2 of Ajanta (Schlingloff, 1976)

India's textile industry, which was the best in the world, was decimated by the British. They cut off India's export markets by a variety of means. The Calico Act of 1721, intended to protect the wool and silk industries, banned most cotton cloths. The Act was repealed in 1774, but Indian textiles entering the British market faced stiff import duties, ranging from 27–59% ad valorem in 1803 to 71–85% in 1813.

When the mechanization brought about by the industrial revolution gave their own textiles a cost advantage, the British made sure that India was not provided the resources to build its own factories. As India became deindustrialized, it turned into a huge monopoly market for British products. British Raj made token investments in science and technology.

Jobs in India simply disappeared. Outside of village crafts, and sparsely staffed revenue and medical departments and schools, one could only find jobs in the army or police or as clerks working for urban enterprises. When the railway system was built by the British, the employees for a long time could only be British or Anglo-Indians.

More and more people became servants and cooks, if they could find anything. They became office seekers: any government position, even if only of the attendant in an office, was considered supremely desirable.

Nearing the end of their depredation of India, the British created national services. In 1920, India's scientific services had a total of 213 scientists of whom 195 were British![6]

Comparing the path India chose with that of Japan, Sri Aurobindo argued that Japan embraced Western science while keeping to its spirit of the samurai, while India was compelled to abandon its own genius for the security of work in the office to serve the colonialists.[7]

This was the model that goes back to the British outpost at Fort St. George where Indians kept books or did other menial jobs. This has continued in recent times where Indian companies serve as the back office to Western companies without the ambition to make their own products. Likewise, as a consequence of a bizarre and misguided education policy over

the last 70 years, Indian school and college curricula continue to present history through the colonial lens and so most Indians are largely ignorant of their scientific and cultural heritage.[8]

This essay is a broad overview of Indian science with general references so that the reader can obtain the details easily.

SOURCES OF INDIAN SCIENCE

Indian archaeology and literature provide considerable layered evidence related to the development of science and material progress. The chronological time frame for this history is provided by the archaeological record that has been traced, in an unbroken tradition, to about 8000 BCE. Prior to this date, there are records of rock paintings that are considerably older.[9]

The third millennium is characterized by a very precise system of weights and monumental architecture using cardinal directions. Indian writing (the so-called Indus script) goes back to the beginning of the third millennium BCE, but it has not yet been deciphered. However, statistical analysis shows that the later historical script called Brahmi evolved from this writing.

The earliest textual source is the Ṛgveda, which is a compilation of very ancient material. The astronomical references in the Vedic books recall events of the third or the fourth millennium BCE and earlier. The discovery that Sarasvati, the preeminent river of the Ṛgvedic times, went dry around 1900 BCE, if not earlier, suggests that portions of the Ṛgveda may be dated prior to this epoch.

Briefly, the Vedas speak of a tripartite and recursive world view.[10] The universe is experienced in triples: regions of earth, space, and sky; body, breath (prāṇa), and mind; body, mind, and consciousness; past, present, and future. These triples are symbolized in the trinity of Brahmā, Viṣṇu, and Maheśa. The trinity may, on in one's experience, by seen in dualities. The matter-consciousness and mind-consciousness dualities are represented in the pair of Śakti and Śiva. In the domain of human action, the orders if morality and freedom are represented by Viṣṇu and Śiva.

The outside and the inner processes are taken to be connected. All material systems go though changes with time and this includes the universe. All descriptions lead to logical paradox, and the one category transcending all oppositions is Brahman. Vedic ritual is a symbolic retelling of this conception.

LAWS AND COSMOLOGY

Vedic cosmology may be unpacked into the following seven components that help us visualize the foundations of Indian science in terms of its overarching elements and facilitates comparison with modern views:[11]

1. *A Universe Governed by Laws and Characterized by Paradox.* The universe with matter and consciousness is governed by *ṛta* (laws). Since consciousness is not material, language cannot describe reality fully and linguistic descriptions suffer

from paradox. The irreconcilable subject/object dichotomy represents complementary aspects of the same transcendental reality.[12]

2. *An Atomic World*. The conscious subject is separate from the material reality but is, nevertheless, able to direct its evolution. The universe is infinite in size and infinitely old, and other worlds beyond our solar system exist. The universe itself go through cycles of creation and destruction.[13]

3. *Relativity of Time and Space.* Time and space are created by the mind and they do not flow at the same rate for different observers.[14]

4. *Evolution of Life*. Humans arose at the end of a chain where the beginning was with plants and various kinds of animals.[15]

5. *A Science of Mind*. The inner space has its own architecture that is accessible to analysis.[16]

6. *Mathematical Reality*. Because physical reality is atomic, it is accessible to enumeration and mathematics.[17]

7. *Recursion.* The properties of the universe are mirrored across different scales as in the formula *yat piṇḍe tad brahmāṇḍe*.[18]

Due to recursion, the complementarity of consciousness and matter manifests itself in many dualities of experience. The world can be seen through the tropes of unity and multiplicity as well as freedom and deterministic evolution. Complementarity is associated with epistemology and ontology and perspectives are described in binary pairs: logic (Nyāya) and physics (Vaiśeṣika), cosmology (Sāṅkhya) and psychology (Yoga), and language (Mīmāṃsā)and reality (Vedānta).

The Sāṅkhya and the Yoga systems take the mind as consisting of five components: manas, ahaṃkāra, citta, buddhi, and ātman. Manas is the lower mind which collects sense impressions, and ahaṃkāra is the sense of I-ness that associates some perceptions to a subjective and personal experience, citta is the ever-altering memory bank. Once sensory impressions have been related to I-ness by ahaṃkāra, their evaluation and resulting decisions are arrived at by buddhi, the intellect.

There is evidence of the knowledge of biological cycles and awareness that there exist two fundamental rhythms in the body: the 24-hour related to the sun, and the 24 hour and 50 minute related to the period of the moon (the moon rises about 50 minutes later every day). This knowledge is not surprising since monthly rhythms, averaging 29.5 days, are reflected in the reproductive cycles of many marine plants and those of animals. The Ṛgveda 10.90

speaks of these connections by saying that the moon was born of the mind and the sun was born of the eyes of the cosmic self:

candramā mana'so jātaḥ | *cakṣoḥ sūryo' ajāyata* | RV 10.90.13

The connection between the outer and the inner cosmos is seen most strikingly in the use of the number 108 in Indian literary and artistic expression. It was known that this number is the approximate distance from Earth to the sun and the moon, in sun and moon diameters, respectively.[19] This number was probably obtained by taking a pole of a certain height to a distance 108 times its height and discovering that the angular size of the pole was the same as that of the sun or the moon. It is a curious fact that the diameter of the sun is also approximately 108 times the diameter of Earth.

This number of dance poses (karaṇas) given in the Nāṭya Śāstra is 108, as is the number of beads in a japamālā. The distance between the body and the inner sun is also taken to be 108, and thus there are 108 names of the gods and goddesses. The number of *marmas* (weak points) in Āyurveda is 107, because in a chain 108 units long, the number of weak points would be one less.

PHYSICAL LAWS AND MOTION

The history of Indian physics goes back to Kaṇāda (~ 600 BCE) who asserted that all that is knowable is based on motion, thus giving centrality to laws and their operational analysis in the understanding of the universe.[20]

There are nine classes of substances: ākāśa, space, and time that are continuous; four elementary substances (or particles) called earth, air, water, and fire that are atomic; and two kinds of mind, one omnipresent and another which is the individual.

Let the basic atoms of pṛthvi, āpaḥ, tejas, and vāyu be represented by P, Ap, T, and V, respectively. Every substance is composed of these four kinds of atoms. Consider gold in its solid form; its mass derives principally from the P atoms. When it is heated, it becomes a liquid and therefore there should be another kind of an atom already in gold which makes it possible for it to take the liquid form and this is Ap. When heated further it burns and this is when the T atom gets manifested. When heated further, it loses its mass ever so slightly, and this is due to the loss of the V atoms.

The atoms are eternal only under normal conditions, and during creation and destruction, they arise in a sequence starting with ākāśa and are absorbed in the reverse sequence at the end of the world cycle. The sequence of evolution of the elements is given as V→T→Ap→P. The V and T atoms have little mass (since they do not exist in a substantive form), whereas P and Ap atoms have mass. This sequence also hides within it the possibility of transformation from V and T atoms that are energetic to the more massive Ap and P atoms.

Indian chemistry developed many different alkalis, acids, and metallic salts by processes of calcination and distillation, often motivated by the need to formulate medicines. Metallurgists developed efficient techniques of extraction of metals from ore.[21]

ASTRONOMY

We know quite a bit about how astronomical science evolved in India. The Yajurvedic sage Yājñavalkya knew of a ninety-five-year cycle to harmonize the motions of the sun and the moon, and he also knew that the sun's circuit was asymmetric. The second millennium BCE text Vedāṅga Jyotiṣa of Lagadha[22] went beyond the earlier calendrical astronomy to develop a theory for the mean motions of the sun and the moon. An epicycle theory was used to explain planetary motions. Given the different periods of the planets, it became necessary to assume yet longer periods to harmonize their cycles. This led to the notion of mahāyugas and kalpas with periods of billions of years.

The innovations of the division of the circle into 360 parts and the zodiac into 27 nakṣatras and 12 rāśis took place first in India. The schoolbook accounts of how these innovations first emerged in Mesopotamia in the 7th century BCE and then arrived in India centuries later are incorrect because both these divisions are described in the Ṛgveda.

The Śatapatha Brāhmaṇa which was compiled soon after the Vedas says: "The sun strings these worlds [the earth, the planets, the atmosphere] to himself on a thread. This thread is the same as the wind…" This suggests a central role to the sun in defining the motions of the planets and ideas such as these must have ultimately led to the theory of expanding and shrinking epicycles.

Astronomical texts called siddhāntas begin appearing sometime in the first millennium BCE. According to the tradition there were eighteen early siddhāntas, of which only a few have survived. Each siddhānta is an astronomical system with its own constants. The Sūrya Siddhānta speaks of the motion of planets governed by "cords of air" that bind them, which is a conception like that of the field.

The great astronomers and mathematicians include Āryabhaṭa, who took Earth to spin on its own axis and who spoke of the relativity of motion and provided outer planet orbits with respect to the sun. This work and that of Brahmagupta (b. 598) and Bhāskara (b. 1114) was passed on to Europe via the Arabs. The Kerala School with figures such as Mādhava (c. 1340–1425) and Nīlakaṇṭha (c. 1444–1545) came up with new innovations of analysis based on advanced mathematics.[23]

EVOLUTION OF LIFE

The Sāṅkhya system speaks of evolution both at the levels of the individual as well as the cosmos. The Mahābhārata and the Purāṇas have material on creation and the rise of humankind. It is said that man arose at the end of a chain that began with plants and various kind of animals. In Vedic evolution the urge to evolve into higher forms is taken to be inherent in nature. A system of an evolution from inanimate to progressively higher life is assumed to be a consequence of the different proportions of the three basic attributes of the guṇas (qualities): sattva ("truth" or "transparence"), rajas (activity), and tamas ("darkness" or "inertia"). In its undeveloped state, cosmic matter has these qualities in equilibrium. As the world evolves,

one or the other of these becomes preponderant in different objects or beings, giving specific character to each.

The Purāṇas (such as Viṣṇu, Garuḍa, Skanda) speak of 8.4 million species on the earth and in the oceans, which, astonishingly, turns out to be nearly identical to modern estimates.[24]

GEOMETRY AND MATHEMATICS

Indian geometry began very early in the Vedic period in altar problems, as in the one where the circular altar is to be made equal in area to a square altar. The historian of mathematics, Abraham Seidenberg, saw the birth of geometry and mathematics in the solution of such problems.[25] Two aspects of the "Pythagoras" theorem are described in the texts by Baudhāyana and others. Problems are presented with their algebraic counterparts.[26] The solution to planetary problems led to the further development of algebraic methods.

The sign for zero within the place value decimal number system that was to revolutionize mathematics and facilitate development of technology appears to have been devised around 50 BCE to 50 CE. Indian numerals were introduced to Europe[27] by Fibonacci (13th century) who is now known for a sequence that was described earlier by Virahaṅka (between 600 and 800), Gopāla (prior to 1135) and Hemacandra (~1150 CE). Nārāyaṇa Paṇḍit (14th century) showed that these numbers were a special case of the multinomial coefficients.[28]

Bharata's Nāṭya Śāstra has results on combinatorics and discrete mathematics, and Āryabhaṭa has material on mathematics including methods to solve numerical problems effectively. Later source materials include the works of Brahmagupta, Lalla (eighth century), Mahāvīra (ninth century), Jayadeva, Śrīpati (eleventh century), Bhāskara, and Mādhava.[29] In particular, Mādhava's derivation and use of infinite series predated similar development in Europe, which is normally seen as the beginning of modern calculus.[30] Some scholars believe these ideas were carried by Jesuits from India to Europe and they eventually set in motion the Scientific Revolution.[31]

A noteworthy contribution was by the school of New Logic (Navya Nyāya) of Bengal and Bihar. At its zenith during the time of Raghunātha (1475–1550), this school developed a methodology for a precise semantic analysis of language. Navya Nyāya foreshadowed mathematical logic and there is evidence that it influenced modern machine theory.[32]

GRAMMAR

Pāṇini's grammar Aṣṭādhyāyī (Eight chapters) of the fifth century BCE provides four thousand rules that describe Sanskrit completely. This grammar is acknowledged to be one of the greatest intellectual achievements of all time. The great variety of language mirrors, in many ways, the complexity of nature and, therefore, success in describing a language is as impressive as a complete theory of physics. Scholars have shown that the grammar of Pāṇini represents a universal grammatical and computing system. From this perspective, it anticipates the logical framework of modern computers.

The Aṣṭādhyāyī contains a meta-language, meta-rules, and other technical devices that make this system effectively equivalent to the most powerful computing machine. No grammar of similar power has yet been constructed for any other language. The famous American scholar Leonard Bloomfield called Panini's achievement as "one of the greatest monuments of human intelligence."

MEDICINE

Āyurveda, the Indian medicine system, is a holistic approach to health that builds upon the tripartite Vedic approach to the world. Health is maintained through a balance between three basic humors (doṣa) of wind (vāta), fire (pitta), and water (kapha). Each of these humors had five varieties. Although literally meaning "air," "bile," and "phlegm," the doṣas represented larger principles.[33]

Caraka and Suśruta are two famous early physicians. According to Caraka, health and disease are not predetermined, and life may be prolonged by human effort. Suśruta defines the purpose of medicine to cure the diseases of the sick, to protect the healthy, and to prolong life. The Saṃhitās speak of organisms that circulate in the blood, mucus, and phlegm. In particular, the organisms in the blood that cause disease are said to be invisible. It is suggested that physical contact and sharing the same air can cause such diseases to spread. Inoculation was practiced for protection against smallpox.

Indian surgery was quite advanced. The caesarian section was known, as was plastic surgery, and bone setting reached a high degree of skill. Suśruta classified surgical operations into eight categories: incision, excision, scarification, puncturing, probing, extraction, evacuation and drainage, and suturing. Suśruta lists 101 blunt and 20 sharp instruments that were used in surgery. The medical system tells us much about the Indian approach to science. There was emphasis on observation and experimentation.

MIND AND CONSCIOUSNESS

Vedic deities represent cognitive centers.[34] It is asserted that parā-vidyā or ātma-vidyā (science of consciousness) cannot be described in words or design. In the Śrī-yantra, which is a representation of the cosmos, consciousness (Śiva) is shown as an infinitesimal dot in the middle.

The interaction between matter and consciousness is postulated in terms of an observation process called *dṛṣṭi-sṛṣṭi* (creation through observation), which is consistent with a universe governed by laws.[35]

Indian texts assert that the phenomenon of consciousness cannot be studied directly as a material property. Their analysis of consciousness using indirect methods may very well be relevant for further progress of this question in contemporary science.

SCIENTIFIC SPECULATIONS

Indian thought is unique in the breadth and scope of its scientific speculations that are scattered within its high literature. These range from airplanes (Rāmāyaṇa) to weapons that can

destroy the world (Mahābhārata), and to the most astonishing abstract ideas in the Yoga-Vāsiṣṭha.

The Mahābhārata has an account of an embryo divided into one hundred parts each becoming, after maturation in a separate pot, a healthy baby. There is also mention of a conception in one womb transferred to another. It also has a major section on battle with a space ship whose occupants wear airtight suits (Saubha Parva).

Universes defined recursively are described in the famous episode of Indra and the ants in Brahmavaivarta Purāṇa. These flights of imagination are more than a straightforward generalization of the motions of the planets into a cyclic universe.

The context of modern science fiction is clear: it is the liberation of the earlier modes of thought by the revolutionary developments of the 20th century science and technology. To understand why speculations were integrated into mainstream Indian literary tradition one must appreciate the centrality of the idea of ātman. Since creativity is seen to emerge not from the instrumentality of the mind but from the ātman, Indian science privileges imagination and abstraction at the highest level. Science is then an attempt to understand the dynamics of embodied consciousness both in outer and inner realms, and this notion is carried beyond into the aesthetic theory of *dhvani*[36] that posits that beauty in a creative expression is from the resonance that takes the viewer or the listener to the transcendence within.

CONCLUSIONS

India's civilization valued science and knowledge above all and created some of the most extraordinary conceptual advances. These include a cosmos with many solar like systems, the earliest astronomy, geometry, number theory, the ten-digit counting system and the symbol for zero, the idea of physical laws and invariance, the earliest formal system to describe a complex natural phenomenon (as in Pāṇini's computer program-like grammar that was not rivaled for 2,500 years), a very subtle psychology, the notion of health as harmony within the body and mind, the idea of invisible germs that cause infectious disease, immunization to prevent certain illnesses, and the notion of interrelatedness in nature.

Indian ideas have provided key notions[37] in the rise of modern science. But now in spite of great advances, we are unable to reconcile the sense of freedom and agency within the framework of machine-like laws, and in physical theory there is no place for the observer. Indian intuitions about the nature of consciousness and the approach to physics and psychology that privileges human agency may yet provide key clues for future advances in many frontiers of science.

NOTES

This is an expanded version of my essay titled "Science" for Stanley Wolpert's Encyclopedia of India (Charles Scribners & Sons, 2005), and a later version that appeared in Medium.

1. Chakrabarti and Patnaik (2019)
2. Dharampal (1971), Dharampal (1983), Alvares (1991)

3. al-Andalusi (1991)
4. Parsons (1808)
5. Schlingloff (1976)
6. Arnold (2000)
7. Aurobindo (1909)
8. Alvares (1991), Dharampal (1971), Kak (2016d)
9. Kak (2000), Kak (2010), Kak (2015); see also Vahia and Menon (2013)
10. Kak (2015), Kak (2016c)
11. This is a rewording of a list that appeared in Kak (2005)
12. Kak (2016d); see also Seal (1985) for original references from the texts.
13. Kak (2016a)
14. Obviously, we are not speaking here of the mathematical theory of relativity regarding an upper limit to the speed of light, yet the consideration of time acting different to different observers is quite remarkable. Thus in a story in the Bhāgavata Purāṇa (9.3.29): "Taking his daughter, Kakudmi went to Brahmā, and inquired about a husband for her. But Brahmā was at a musical performance by the Gandharvas and had not a moment to talk with him. When he was free at the end of the performance, Brahmā laughed and said to Kakudmi, 'O King, many ages have passed while you were waiting. Those upon whom you may have decided are now gone, and so are their sons, grandsons. and other descendants.'" In the astronomical context, Āryabhaṭa speaks of the relativity of motion (see e.g. Shukla and Sarma (1976) and Kak (2016f)).
15. The Mahābhārata and the Purāṇas have material on creation and the rise of mankind. Here's the quote from the Yoga Vāsiṣṭha: "I remember that once upon a time there was nothing on this earth, neither trees and plants, nor even mountains. For a period of eleven thousand years (four million earth years) the earth was covered by lava. Then demons (asuras) ruled the earth; they were deluded and powerful. The earth was their playground. And then for a very longtime the whole earth was covered with forests, except the polar region. Then there arose great mountains, but without any human inhabitants. For a period of ten thousand years (4 million earth years) the earth was covered with the corpses of the asuras."
16. Kak (2002), Kak (2004), and Kak (2016b)
17. The great Vedic ritual was related to the motions of the sun and the moon (Kak, 2016e). A binary number system was used by Piṅgala to represent Vedic meters, and the structure of this number system may have helped in the invention of the sign for zero. In the idea of infinity in the Vedas, it is correctly understood that addition and subtraction of infinity from it leaves it unchanged.
18. Kak (2016c), Kak (2016d)
19. Kak (2016e)
20. Kak (2016a), Kak (2016d)
21. Ray (1909), Biswas (1986), Balasubramanian (2002)
22. Sastry (1985); Kak (2016e)
23. Shukla and Sarma (1976), Raju (2001), Ramasubramanian and Srinivas (2010)
24. See C. Mora et al., How many species are there on earth and in the ocean? PLoS Biol 9, (2011); this is a most astonishing coincidence.
25. Seidenberg (1962), Seidenberg (1978)
26. Saraswathi Amma (1979)
27. Ifrah (2000)
28. Srinivasiengar (1967), Seshadri (2010)
29. Datta and Singh (1962), Selenius (1975), Joseph (2000)
30. Joseph (2000), Pearce (2000)
31. Joseph (2000) with addition references in Kak (2018)
32. Rao and Kak (2016); also see Kak (2018)
33. Patwardhan (2012), Jaiswal et al. (2016), and Raghava Varier (2020)
34. Kak (2002)

35. In the orthodox interpretation of quantum theory, consciousness is a separate category as in Vedanta and the quantum Zeno effect is consistent with *dṛṣṭi-sṛṣṭi.*
36. See Ingalls, Masson and Patwardhan (1990)
37. See Kak (2018).

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31
Indian Foundations of Modern Science*

INTRODUCTION

Scholars see India and Greece as the two principal birthplaces of science [1]. School textbooks tell us about Pythagoras, Aristotle, Euclid, Archimedes, and Ptolemy, geometry of the Vedic altars, the invention of zero in India, Yoga psychology, and Indian technology of steel-making that went into the manufacture of the best swords. But if you take the trouble of reading scholarly books, articles and encyclopedias, you will find that in many ways the early Indian contributions are the more impressive for they include a deep theory of mind, Pāṇini's astonishing Sanskrit grammar, binary numbers of Piṅgala, music theory, combinatorics, algebra, earliest astronomy, and the physics of Kaṇāda with its laws of motion.

Of these, Kaṇāda is the least known. He may not have presented his ideas as mathematical equations, but he attempted something that no physicist to date has dared to do: he advanced a system that includes space, time, matter, as well as observers. He also postulated four types of atoms, two with mass and two with little mass, and the idea of invariance [2] [Note 1]. A thousand or more years after Kaṇāda, Āryabhaṭa postulated that earth rotated and advanced the basic idea of relativity of motion [3].

And then there is India's imaginative literature, which includes the Epics, the Purāṇas and the Yoga Vāsiṣṭha (perhaps the greatest novel ever written), that speaks of time travel, airplanes, exoplanets (that is many solar-like systems), cloning of embryos, sex change, communication over distances, and weapons that can destroy everything [4]. Some nationalists take these statements to mean the literal scientific truth, which claim is ridiculed by their political opponents who then use this broad brush to tar all Indian science.

There are also anomalous statements in Indian texts whose origin is not understood. Just to mention a few: the correct speed of light, the correct distance to the sun, cosmological cycles that broadly correspond to the numbers accepted currently, the fact that the sun and the moon are approximately 108 times their respective diameters from the earth [5], the correct number of species on earth (about 8.4 million), and so on [6]. Historians either ignore them or say that they are extraordinary coincidences. We will come to these anomalies later in the essay.

To return to the history of mainstream science, the discovery of infinite series and calculus by Newton and Leibniz heralded the Scientific Revolution that was to change the world. But new research has shown that over two centuries prior the Kerala School of Mathematics had already developed calculus [7][8] and some historians suggest that this and advanced astronomical knowledge from Kerala went abroad via the Jesuits and provided the spark for its further development in Europe. Other historians discount this saying that clear

* Medium and Academia.edu

proof of the transmission of this knowledge to Europe is lacking.

There is more agreement about the many achievements of Indian medical sciences. For example, the Royal Australia College of Surgeons in Melbourne, Australia has a prominent display of a statue of Suśruta (600 BCE) with the caption "Father of Surgery". The ancient Ayurveda texts include the notion of germs and inoculation and also postulate mind-body connection, which has become an important area of contemporary research.

Indian medicine was strongly empirical; it used Nature (which is governed by Ṛta) as guide, and it was informed by a sense of skepticism. In the West the notion of skepticism is usually credited to the Scottish philosopher of science, David Hume, but scholars have been puzzled by the commonality between his ideas and the earlier Indian ones. Recently, it was shown that Hume almost certainly learnt Indian ideas from Jesuits when he was at the Royal College of La Flèche in France [9].

There are also indirect ways that Indian ideas led to scientific advance. Mendeleev was inspired by the two-dimensional structure of the Sanskrit alphabet to propose a similar two-dimensional structure of chemical elements [10].

A Vedantic vision guided Jagadis Chandra Bose in his pathbreaking discoveries in a variety of fields. Bose is considered the true father of radio science which, as we know, has changed the world [11]. Bose also discovered millimeter length electromagnetic waves and was a pioneer in the fields of semiconductor electronics and biophysics [12].

Erwin Schrödinger, a founder of quantum theory, credited ideas in the Upanishads for the key notion of superposition [13] that was to bring about the quantum revolution in physics that changed chemistry, biology, and technology [13][14].

I now briefly touch upon Indian influence on linguistics, logic, philosophy of physics, and theory of mind.

LINGUISTICS, ALGORITHMS AND SOCIETY

Pāṇini's work (4th or 5th century BCE) showed the way to the development of modern linguistics through the efforts of scholars such as Franz Bopp, Ferdinand de Saussure, Leonard Bloomfield, and Roman Jakobson. Bopp was a pioneering scholar of the comparative grammars of Sanskrit and other Indo-European languages. Ferdinand de Saussure in his most influential work, Course in General Linguistics (Cours de linguistique générale), that was published posthumously (1916), took the idea of the use of formal rules of Sanskrit grammar and applied them to general linguistic phenomena.

The structure of Pāṇini's grammar contains a meta-language, meta-rules, and other technical devices that make this system effectively equivalent to the most powerful computing machine [15]. Although it didn't directly contribute to the development of computer languages, it influenced linguistics and mathematical logic that, in turn, gave birth to computer science.

The works of Pāṇini and Bharata Muni also presage the modern field of semiotics which is the study of signs and symbols as a significant component of communications. Their template may be applied to sociology, anthropology and other humanistic disciplines for all

social systems come with their grammar.

The search for universal laws of grammar underlying the diversity of languages is ultimately an exploration of the very nature of the human mind. But the Indian texts remind that the other side to this grammar is the idea that a formal system cannot describe reality completely since it leaves out the self.

MODERN LOGIC

That Indian thought was central to the development of machine theory is asserted by Mary Boole — the wife of George Boole, inventor of modern logic — who herself was a leading science writer in the nineteenth century. She claimed that George Everest, who lived for a long time in India and whose name was eventually applied to the world's highest peak, was the intermediary of the Indian ideas and they influenced not only her husband but the other two leading scientists in the attempt to mechanize thought: Augustus de Morgan and Charles Babbage. She says in her essay on Indian Thought and Western Science in the Nineteenth Century (1901): "Think what must have been the effect of the intense Hinduizing of three such men as Babbage, De Morgan, and George Boole on the mathematical atmosphere of 1830–65." She further speculates that these ideas influenced the development of vector analysis and modern mathematics [16].

Much prior to this, Mohsin Fani's Dabistani-i Madhahib (17th Century) claimed that Kallisthenes, who was in Alexander's party, took logic texts from India and the beginning of the Greek tradition of logic must be seen in this material [17]. In Indian logic, minds are not empty slates; the very constitution of the mind provides some knowledge of the nature of the world. The four pramāṇas through which correct knowledge is acquired are direct perception, inference, analogy, and verbal testimony.

UNIVERSAL GRAVITATION

Indian physics, which goes back to the Vaiśeṣika Sūtras (c. 500 BCE), is not believed to have directly influenced the discovery of physical laws in Europe, but these ideas were an integral part of Indian sciences so they must have played a role in the formulation of scientific questions as Indian ideas traveled west. Kaṇāda had spoken of how objects fall due to gravitation, and his ideas included those of symmetry and invariance that arose from the premise that the universe consisted of innumerable star-systems like out solar system, in contrast to the Western idea of earth being the center of the universe. We have no explicit knowledge that Kaṇāda believed that gravitation worked beyond the earth, although it appears to be implicit in the idea that other solar systems exist [18].

The great Bhāskara (1114–1185) in his Siddhānta-Śiromaṇi presented gravitation as a universal principle:

> ākṛṣṭiśaktiśca mahī tayā yarakhasthaṃ guru svābhimukhaṃ svaśakyā ।
> ākṛṣyate tapatatīva bhāti same samantāt patatviyaṃ khe ॥ 6 ॥

> "The earth exerts an attractive force, by which other massive objects in space fall on it. But when attractive force on objects in space balances out, how would they fall?" (Golādhyāya 6) [This explains why planets do not fall on earth or on other massive bodies.]

Just so that there is no misunderstanding, Bhāskara did not present a mathematical expression for gravitational force.

If Bhāskara's idea of universality of gravitation reached Europe via the Jesuits, then he should be credited with one of the most significant advances in physics before Newton.

PHYSICS WITH OBSERVERS

Indian ideas that place the observer at center prefigure the conceptual foundations of modern physics, and this is acknowledged by the greatest physicists of the twentieth century.

In the West, the universe was seen as a machine going back to Aristotle and the Greeks who saw the physical world consisting of four kinds of elements of earth, water, fire, and air. This model continued in Newton's clockwork model of the solar system. Indian thought, in contrast, has a fifth element, ākāśa, which is the medium for inner light and consciousness. With the rise of relativity theory and quantum mechanics, the observer could no longer be ignored. In one sense, the journey of science is the discovery of self and consciousness [19].

Kaṇāda's Vaiśeṣika Sūtras speak of how properties of matter are to be derived from substances, their attributes and motions, but our perception of these properties derives from how the mind interacts with the physical system.

It is one of those obscure footnotes to the history of physics that Nikola Tesla, who was very famous in the 1890s, was asked by Swami Vivekananda to find an equation connecting mass and energy. We know that Tesla didn't quite succeed at this but he was to work on various models of wireless transfer of energy for the remainder of his career.

COSMOLOGY AND EVOLUTION

The Ṛgveda speaks of the universe being infinite in size. The evolution of the universe is according to cosmic law. Since it cannot arise out of nothing, the universe must be infinitely old. Since it must evolve, there are cycles of chaos and order or creation and destruction. The world is also taken to be infinitely old. Beyond the solar system, other similar systems were postulated, which appear to have been confirmed with the modern discovery of exoplanets.

The Sāṅkhya system describes evolution at cosmic and individual levels. It views reality as being constituted of puruṣa, consciousness that is all-pervasive, and prakṛti, which is the phenomenal world. Prakṛti is composed of three different strands (guṇas or characteristics) of sattva, rajas, and tamas, which are transparency, activity, and inactivity, respectively.

Evolution begins by puruṣa and prakṛti creating mahat (Nature in its dynamic aspect). From mahat evolves buddhi (intelligence) and manas (mind). Buddhi and manas in the large scale are Nature's intelligence and mind. From buddhi come individualized ego

consciousness (ahaṅkāra) and the five tanmātras (subtle elements) of sound, touch, sight, taste, smell. From the manas evolve the five senses (hearing, touching, seeing, tasting, smelling), the five organs of action (with which to speak, grasp, move, procreate, evacuate), and the five gross elements (ākāśa, air, fire, water, earth).

The evolution in Sāṅkhya is an ecological process determined completely by Nature. It differs from modern evolution theory in that it presupposes a universal consciousness. In reality, modern evolution also assigns intelligence to Nature in its drive to select certain forms over others as well as in the evolution of intelligence itself.

The description of evolution of life is given in many texts such as the Mahābhārata. I present a quote from the Yoga Vāsiṣṭha on it:

> "Remember that once upon a time there was nothing on this earth, neither trees and plants, nor even mountains. For a period of eleven thousand [great] years the earth was covered by lava. In those days there was neither day nor night below the polar region: for in the rest of the earth neither the sun nor the moon shone. Only one half of the polar region was illumined. [Later] apart from the polar region the rest of the earth was covered with water. And then for a very long time the whole earth was covered with forests, except the polar region. Then there arose great mountains, but without any human inhabitants. For a period of ten thousand years the earth was covered with the corpses of the asuras." [YV 6.1]

The reverse sequence, of the end of the world, is also described in various texts. First, the sun expands in size incinerating everything on the earth (quite similar to modern accounts of the aging sun becoming a red giant). The specific sequence mentioned is that the fireball of the sun transforms the Pṛthivī atoms into Āpas atoms, which then together change into Tejas atoms and further into Vāyu atoms, and finally to sound energy that is an attribute of space, and so on (Mahābhārata, Śānti Parva Section 233). In our modern language, it means that as temperatures become high, matter breaks down becoming a sea of elements, then the protons break down into electrons, further into photons, and finally into neutrinos, and on to acoustic energy of space. At the end of this cycle the world is absorbed into Consciousness.

Vivekananda was aware of this sequence which is why he asked Tesla to find the specific equation for transformation between mass and energy.

MIND AND YOGA

We are in the midst of a worldwide Yoga revolution. For many, it is about health and well-being but that is only a portal that leads to the understanding of the self and its relationship with the body.

Although the roots of Yoga lie in the Vedas, most read Patañjali's Yoga-sūtra for a systematic exposition of the nature of the mind. The text is logical and it questions the naïve understanding of the world. According to it, there is a single reality and the multiplicity we see in it is a consequence of the projections of our different minds. Therefore, to obtain knowledge one must experience reality in its most directness.

The Vedic texts claim to be ātmavidyā, "science of self" or "consciousness science" and they also provide a framework to decode its narrative, establishing its central concern with consciousness.

In the Vedic view, reality is unitary at the deepest level since otherwise there would be chaos. Since language is linear, whereas the unfolding of the universe takes place in a multitude of dimensions, language is limited in its ability to describe reality. Because of this limitation, reality can only be experienced and never described fully. All descriptions of the universe lead to logical paradox.

Knowledge is of two kinds: the higher or unified and the lower or dual. The higher knowledge concerns the perceiving subject (consciousness), whereas the lower knowledge concerns objects. The higher knowledge can be arrived at through intuition and meditation on the paradoxes of the outer world. The lower knowledge is analytical and it represents standard sciences with its many branches. There is a complementarity between the higher and the lower, for each is necessary to define the other, and it mirrors the one between mind and body [20].

THE FUTURE OF SCIENCE

I have gone through a random list of topics to show that Indian ideas and contributions have shaped science in fundamental ways. I hope to show now that they remain equally central to its future growth.

We first note that in spite of its unprecedented success and prestige, science is facing major crises. The first of these crises is that of physics for it has found no evidence for dark matter and dark energy that together are believed to constitute 95% of the observable universe, with another 4.5% being intergalactic dust that doesn't influence theory. How can we claim that we are near understanding reality if our theories are validated by only 0.5% of the observable universe?

The second crisis is that neuroscientists have failed to find a neural correlate of consciousness. If there is no neural correlate, then does consciousness reside in a dimension that is different from our familiar space-time continuum? And how do mind and body interact with each other?

The third crisis is that there is no clear answer to the question if machines will become conscious. The fourth crisis is related to the implications of biomedical advances such as cloning on our notions of self.

It becomes clear that the three crises are actually interrelated when it is realized that consciousness is also an issue at the very foundations of physics. These questions also relate to the problem of free will.

Researchers are divided on whether conscious machines will ever exist. Most computer scientists believe that consciousness is computable and that it will emerge in machines as technology develops. But there are others who say there're things about human behavior that cannot be computed by a machine. Thus creativity and the sense of freedom people possess appear to be more than just an application of logic or calculations.

QUANTUM VIEWS

Quantum theory, which is the deepest theory of physics, provides another perspective. According to its orthodox Copenhagen Interpretation, consciousness and the physical world are complementary aspects of the same reality. Since it takes consciousness as a given and no attempt is made to derive it from physics, the Copenhagen Interpretation may be called the "big-C" view of consciousness, where it is a thing that exists by itself — although it requires brains to become real. This view was popular with the pioneers of quantum theory such as Niels Bohr, Werner Heisenberg and Erwin Schrödinger.

The opposing view is that consciousness emerges from biology, just as biology itself emerges from chemistry which, in turn, emerges from physics. We call this less expansive concept of consciousness "little-C." It agrees with the neuroscientists' view that the processes of the mind are identical to states and processes of the brain.

Philosophers of science believe that these modern quantum physics views of consciousness have parallels in ancient philosophy. Big-C is like the theory of mind in Vedanta — in which consciousness is the fundamental basis of reality and at the experienced level it complements the physical universe. The pioneers of quantum theory were aware of this linkage with Vedanta [21].

Little-C, in contrast, is quite similar to what many take to be standard Buddhism. The Buddha chose not to address the question of the nature of consciousness until the end of his life, and many of his followers believe that mind and consciousness arise out of emptiness or nothingness. Yet in the Mahāyāna Mahāparinirvāṇa-sūtra, the Buddha acknowledges a transcendent category underlying constant change which is quite similar to the conception of Vedanta.

BIG-C, ANOMALIES, AND SCIENTIFIC DISCOVERY

Scientists question if consciousness is a computational process. More restrictively, scholars argue that the creative moment is not at the end of a deliberate computation. For instance, dreams or visions are supposed to have inspired Elias Howe's 1845 design of the modern sewing machine and August Kekulé's discovery of the structure of benzene in 1862, and these may be considered to be examples of the anomalous workings of the mind.

A dramatic piece of evidence in favor of big-C consciousness existing all on its own is the life of self-taught mathematician Srinivasa Ramanujan, who died in 1920 at the age of 32. His notebook, which was lost and forgotten for about 50 years and published only in 1988, contains several thousand formulas — without proof in different areas of mathematics — that were well ahead of their time, and the methods by which he found the formulas remain elusive. Ramanujan himself claimed that the formulas were revealed to him by Goddess Nāmagiri while he was asleep [22]. The idea of big-C provides an explanation for the anomalous scientific results from old Indian texts that were mentioned at the beginning of the essay.

The concept of big-C consciousness raises the questions of how it is related to matter,

and how matter and mind mutually influence each other. Consciousness alone cannot make physical changes to the world, but perhaps it can change the probabilities in the evolution of quantum processes as was first proposed by George Sudarshan and Baidyanath Misra in what they called the Quantum Zeno Effect. The act of observation can freeze and even influence atoms' movements, as has been demonstrated in the laboratory, and this may very well be an explanation of how matter and mind interact [23].

With cognitive machines replacing humans at most tasks, the question of what selfhood means will become more central to our lives. It appears to me that the only way to find fulfilment in life will be through wisdom of ātmavidyā. Vedic science will bring humanity full circle back to the source of all experience, which is consciousness. It will also reveal unknown ways mind and body interact and this will have major implications for medicine.

Indian sciences are universal and they have within them the power to inspire people to find their true potential and find meaning in life, as also having the potential to facilitate the next advances in both physical and biological sciences.

Historians may quibble about whether a certain equation should be called Baudhāyana's Theorem or Pythagoras Theorem, but in the larger scheme names do not matter. The direction of science is the more important thing and it is clear that the mystery of consciousness will be one of its major concerns.

NOTES

1. The atoms of Kaṇāda turn out to have interesting parallels with current views in as much that two of them have mass and two have very little mass.
2. For a broad personal bibliography of Indian works that have contributed to modern science, see [24].

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32
History of Indian Physical and Chemical Thought*

INTRODUCTION

We examine the history of the main currents within Indian physics and chemistry within the larger framework of Indian science. The tradition of physics in India is represented by the Vaiśeṣika system which is a conceptual representation of space and the gross visible matter taken to be constructed out of the varying motions of *aṇu*, its most fundamental particle. The Vaiśeṣika system (Śāstri, 2002) represents physical science of the Vedic period and it is unique in that it considers matters as well observers (and consciousness), which no other system has attempted.

The Upaniṣads (e.g. Taittirīya and Śvetāśvatara) present the doctrine of five elements (*mahābhūtas*) that are named earth (*pṛthvī*), water (*āpas*), fire (*tejas*), air (*vāyu*), and ether (*ākāśa*), which represent mass, fluidity, light and fire, gaseousness, and substratum for vibration. Since earth, water, fire, air, and ether are loaded words, from now one we will use the Sanskrit terms for the elements. The Chāndogya Upaniṣad says this of the relationship between the elements of the universe: From this Self (ātman), ākāśa arose; from ākāśa vāyu; from vāyu tejas; from tejas āpas; from āpas pṛthvī. In the Śānti Parva in the Mahābhārata, the sequence of dissolution of the physical universe is as follows: Under extreme heat, pṛthvī becomes āpas, then tejas, then vāyu, then ākāśa, then space, then mind, then time, then energy, and finally universal consciousness.

The transformation sequence of the elements clearly shows that atoms themselves appear from space and prior to that from consciousness. Evolution and transformation is one of the basic characteristics of the system of five elements. Indian physics is a logical system building upon this doctrine that makes it possible to analyze physical reality in a surprisingly comprehensive manner.

General ideas of evolution of the physical universe and how elementary atoms arise out of the subtle tanmātras, explaining the origin of the atoms of Vaiśeṣika, are part of the Sāṅkhya system and are also touched upon in Vedānta texts. Astronomy siddhāntas provide us further information on how motion was considered in astronomy (e.g. Burgess, 1860; Shukla and Sarma, 1976). Additional scattered references of relevance to physical ideas are to be found in the Purāṇas, the Yoga Vāsiṣṭha and the Mahābhārata and of chemical ideas in the Āyurvedic literature. One can situate this further in the background of chronology and writing (Kak, 1994) and a broader development of physical ideas (Kak, 2016b).

The originator of the Vaiśeṣika is Kaṇāda (sometimes also called Ulūka), who is generally believed to have lived around 600 BCE. In the Nyāya, or logic, that is closely tied to the Vaiśeṣika, minds are not empty slates; the very constitution of the mind provides some

* OSU Research Report, 2016

knowledge of the nature of the world. The four *pramāṇas* through which correct knowledge is acquired are direct perception, inference, analogy, and verbal testimony. A translation of the Vaiśeṣika was recently published by the author (Kak, 2016c).

It should be stressed that Indian physical and chemical sciences were not merely theory. Chemical substances were studied on their own for their usefulness in medicine, textiles, food products, dyes, agriculture and metallurgy. These substances were also seen as arising out of different combinations of the atoms of Vaiśeṣika (Ray, 1909). Chemistry was called Rasāyana Śāstra, Rasa-Vidyā, and Rasatantra, which roughly mean 'science of liquids.' The term for a chemical concoction was rasa and the chemist was referred to as a Rasajñya and Rasa-tantra-vid.

Careful observation (in astronomy, agriculture, chemistry, and medicine) and abstract thought (in grammar, cosmology), interconnected by unifying ideas, characterize Indian scientific models that are pragmatic. The measurements are in terms of elaborate systems of times, lengths, and weights. Time was measured using different kinds of clocks and gnomons. The measures of time are defined in the following manner in the Purāṇas and the Arthaśāstra: 15 nimeṣa = 1 kāṣṭhā; 30 kāṣṭhā = 1 kalā; 30 kalā = 1 muhūrta; 30 muhūrta = 1 day-and-night, and variants thereof in other texts (in one text 100 truṭi= 1 tatpara, and 30 tatpara=1 nimeṣa), and beyond this are cycles of yugas of increasingly larger periods that are billions of years long. There was a similarly systematic measurement of lengths with aṅgula (finger) being the base which went to 1 yojana in the scheme: 12 aṅgula= 1 vitasti; 16 vitasti= 1 dhanu (bow length); 1,000 dhanu = 1 yojana (with many other units in between). There were other units that looked at fractions of aṅgula. Rulers made from ivory were in use in the third millennium BCE. One such ruler calibrated to about 1/16 of an inch was found in Lothal.

Scholars have argued that the Harappan measures are the same as the one in the historic period (Balasubramaniam and Joshi, 2008; Danino, 2008). The smallest weights were calibrated with respect to seeds of rice or wheat berry. Figure 1 presents a picture of standardized cubic stone weights from the third millennium BCE Harappan era from the Kot Diji Phase around 2800-2600 BCE. The first seven weights are in the binary sequence 1:2:4:8:16:32:64 (with some anomalous exceptions), where the unit corresponds to 0.856 grams; the most common weight being the 16 unit one. Next are the increments in a decimal system in multiples of 16 in the range 160, 320, and 640. Next are the weights 1,600, 3,200, 6,400, and 12,800. The Arthaśāstra describes standardized measures.

Figure 1. Cubic weights from 2800-2600 BCE (Morley and Renfrew, 2010)

Apart from the study of motion, Indians also studied vibratory phenomena, acoustics, and transforming power of fire. It was known that lightning bolts had electricity and which was taken to be a property of the tejas atoms. Magnetism was also known and the Suśruta Saṃhitā 27 speaks of how a loose unbarbed arrow lodged in a wound with a broad mouth can be withdrawn by the use of a magnet (Bhishagratna, 1907). A compass consisting of an iron fish floating in a pan of oil is described. The attraction of a piece of iron to a magnet is mentioned in the epic poem Kumārasambhava 2.59 by the poet Kālidāsa.

There are accounts of temples with levitating images as in Somnath, which was destroyed by Mahmud of Ghazni in 1025-1026. When the temple fell "the king directed a person to go and feel all around and above it with a spear, which he did but met with no obstacle. One of the attendants then stated his opinion that the canopy was made of loadstone [a magnetized rock], and that the idol was iron and that the ingenious builder had skillfully contrived that the magnet should not exercise a greater force on any one side -- hence the idol was suspended in the middle. When two stones were removed from the summit the idol swerved on one side, when more were taken away it inclined still further, until it rested on the ground." (Elliot and Dowson, 1876, volume 1, page 97)

Although Indian approach to physical reality is pragmatic, a central idea underlying its models is that language cannot describe reality completely. Descriptions are fundamentally incomplete and when stretched beyond normal boundaries they lead to logical paradox. Due to the limitation of language, experienced reality can never described fully. Knowledge is of two kinds: the lower or dual; and the higher or unified. The lower knowledge concerns the world of objects and things, which are subject to change and transformation, whereas the higher knowledge concerns the experiencing self.

Physics and chemistry are a part of lower knowledge. The unfolding of the universe is according to laws (*ṛta*) and the seemingly irreconcilable worlds of the material and the conscious are complementary aspects of the same transcendental reality. In a famous dialog in the Bhāgavata Purāṇa, the sage Nārada instructs that study of lower knowledge until one has realized its limitations is essential preparation for receiving higher knowledge.

Since the universe cannot arise out of nothing, it must be infinitely old. Since it must

evolve, there are cycles of chaos and order or creation and destruction. The Ṛgveda speaks of the universe being infinite in size. A famous mantra speaks of how taking infinity out of infinity leaves it unchanged. This indicates that paradoxical properties of the notion of infinity were known. The world is also taken to be infinitely old. Beyond the solar system, other similar systems were postulated. An infinite size of the universe logically led to the acceptance of many worlds.

The following passage of Mahābhārata 12.182 speaks clearly of the infinite size of the universe in the following words: "The sky you see above is infinite. Its limits cannot be ascertained. The sun and the moon cannot see, above or below, beyond the range of their own rays. There where the rays of the sun and the moon cannot reach are luminaries which are self-effulgent and which possess splendor like that of the sun or the fire. Even these last do not behold the limits of the firmament in consequence of the inaccessibility and infinity of those limits. This space which the very gods cannot measure is full of many blazing and self-luminous worlds each above the other." (Ganguly, 1990)

In my study of the Vaiśeṣika, I have become convinced that Kaṇāda is perhaps one of the greatest natural philosophers before Newton, if for nothing else than the breadth of his conceptual system. He considered symmetry arguments in relation to physical law, defined causality clearly, and anticipated much of Newton in his laws of motion. Further, he did something extraordinary by creating a formal system that includes space, time, matter, as well as observers.

Newton considered space and time to be absolute without explaining what that means. Newton's three laws of motion are: 1. An object remains in the state of rest or motion unless acted upon by force; 2. Force equals mass times acceleration; 3. To every action there is an equal and opposite reaction. For comparison, we begin with certain propositions of Kaṇāda that illustrate his system and then present the sūtras that describe physical laws related to motion. Note that Kaṇāda's atoms are in perennial motion and so he distinguishes between internal and outer motions of an object.

Principle 1. कर्म कर्मसाध्यं न विद्यते॥१।१।११॥
From motion, [new] motion is not known.

Principle 2. कारणाभावात्कार्याभावः ॥१।२।१॥
In the absence of cause, there is an absence of effect [motion].

Principle 3. सामान्यं विशेष इति बुद्ध्यपेक्षम् ॥१।२।३॥
The properties of universal and particular are ascertained by the mind.

Principle 4. सदिति यतोद्रव्यगुणकर्मसु सा सत्ता ॥१।२।७॥
Existence is [self-defined]; substance, attribute, and motion are potential (*sattā*).

Principle 5. सदकारणवन्नित्यम् ॥४।१।१॥
Existence is uncaused and eternal (*nitya*).

The principles have universal applicability. For example, the idea of symmetry is included in the principle of *nitya*, and Kaṇāda explains the roundness of the atom by this principle. The direct statement of causality in Principle 2 is remarkable. Now I present what may be called Kaṇāda's Laws of Motion.

Law 1. संयोगाभावे गुरुत्वात् पतनम् ॥५।१।७॥
In the absence of conjunction, gravity [causes objects to] fall.

Law 2a. नोदनविशेषाभावान्नोर्ध्वं न तिर्य्यग्गमनम् ॥५।१।८॥
In the absence of a force, there is no upward motion, sideward motion or motion in general.

Law 2b. नोदनादाद्यमिषोः कर्म तत्कर्मकारिताच्च संस्कारादुत्तरं तथोत्तरमुत्तरञ्च् ॥५।१।१७॥
The initial pressure [on the bow] leads to the arrow's motion; from that motion is momentum, from which is the motion that follows and the next and so on similarly.

Law 3. कार्य्यविरोधि कर्म ॥१।१।१४॥
Action (kārya) is opposed by reaction (karman).

This list above is a somewhat arbitrary arrangement of Kaṇāda's propositions. The first law is effectively equivalent to Newton's first law for due to Principle 2 the object will either continue to be at rest or in state of motion in the absence of action (including gravitation). The second law, in two parts, falls short, although it has something additional regarding potential. What is missing is an explicit definition of mass in relation to force, although mass is otherwise an element of the exposition. Kaṇāda's third law is identical to Newton's third law.

Most of the early texts of Vaiśeṣika that followed Kaṇāda's sutras are lost. Perhaps this happened due to the high prestige of the commentary on the sutras titled Padārtha-dharma-saṅgraha by Praśastapāda of the fifth or sixth century CE. Other important scholars associated with this tradition include Candramati, Vyomaśiva, Udayana, and Śaṅkara Miśra, the author of an influential commentary called Upaskāra (15th Century CE) (Matilal, 1977; Potter, 1997). The ideas of Vaiśeṣika were further elaborated by scholars of other darśanas. Important contributions to the discussion on the nature of atoms were made by Vyāsa (~4th century) and Vācaspati Miśra (9th or 10th century) who wrote commentaries on the Yoga Sūtra (Prasad, 1912). Many of the commentaries that followed focused on philosophical questions related to inference rather than underlying physical conceptions and will therefore not be considered further in this article.

The ideas of the Vaiśeṣika have also been elaborated within the many schools of Vedanta (in their discussion of physics they are identical) that has influenced modern physics in many ways. Nikola Tesla was inspired to look for methods of harnessing energy from matter and space after learning of the transformation of ākāśa and other elements into energy (during dissolution) from Swami Vivekananda in a meeting in 1896. But he was unable to find the mass to energy equivalence relation (Nikhilananda, 1953).

According to the well-known biography of Schrödinger by Moore, philosophical ideas of Vedānta helped Schrödinger discover the key notion of quantum mechanics that the state function is a sum of all possibilities. Moore adds that in their development of the theory "Schrödinger and Heisenberg and their followers created a universe based on superimposed inseparable waves of probability amplitudes. This new view would be entirely consistent with the Vedāntic concept of All in One." (Moore, 1987)

This article begins with the overarching ideas on cosmology that are essential to situate Indian thinking on the physical world, and then takes up different aspects related to physical law and chemistry. The Vedantic description of transformation of atoms into energy under certain conditions is described. The Vaiśeṣika system is presented in terms of the main propositions on motion and force and ensuing inferences. Further sections include the treatment of relativity of motion by Āryabhaṭa, transformation and evolution, conceptions of atoms and molecules, acoustics and music. The article closes out with a broad summary of Indian chemistry.

THE PHYSICAL WORLD AND THE COSMOS

The Vedic texts present a tripartite and recursive world view. The universe is viewed as three regions of earth, space, and sky which in the human being are mirrored in the physical body, the breath (*prāṇa*), and mind. The processes in the sky, on earth, and within the mind are taken to be connected. This connection is a consequence of a binding (*bandhu*) between various inner and outer phenomena. At one level, it means awareness that certain biological cycles, such as menstruation, have the same period as the moon.

The connection between the outer and the inner cosmos is seen most strikingly in the use of the number 108 in Indian religious and artistic expression. It was known that this number is the distance from the earth to the sun and the moon in sun and moon diameters, respectively. This number was probably obtained by taking a pole of a certain height to a distance 108 times its height and discovering that the angular size of the pole was the same as that of the sun or the moon. The diameter of the sun is also 108 times the diameter of the earth, but that fact may not have been known to the Vedic sages (Kak, 2015).

Like astronomers in other cultures, Vedic astronomers discovered that the periods of the sun and the moon do not coincide. The Yajurvedic sage Yājñavalkya knew of a 95-year cycle to harmonize the motions of the sun and the moon and he also knew that the sun's circuit was asymmetric. Given the different periods of the planets, it became necessary to assume yet longer periods to harmonize their cycles. This ultimately led to the notion of mahāyugas and kalpas with periods of billions of years.

Although there were those who put Earth at the center of the solar system, a pure heliocentrism is to be found in the following statement in the Viṣṇu Purāṇa 2.8: "The sun is stationed for all time, in the middle of the day... The rising and the setting of the sun being perpetually opposite to each other, people speak of the rising of the sun where they see it; and, where the sun disappears, there, to them, is his setting. Of the sun, which is always in one and the same place, there is neither setting nor rising."

The rotation of the earth is inherent in the notion that the sun never sets that we find in the Aitareya Brāhmaṇa 2.7: "The [sun] never really sets or rises. In that they think of him 'He is setting,' having reached the end of the day, he inverts himself; thus he makes evening below, day above. Again in that they think of him 'He is rising in the morning,' having reached the end of the night he inverts himself; thus he makes day below, night above. He never sets; indeed he never sets." (Kak, 2016)

The second millennium text Vedāṅga Jyotiṣa of Lagadha went beyond the earlier calendrical astronomy to develop a theory for the mean motions of the sun and the moon. An epicycle theory was used to explain planetary motions. But unlike the Greek epicycles, the Indian epicycles vary in size in the planetary circuit.

Astronomical texts called siddhāntas begin appearing sometime in the first millennium BCE. According to tradition there were 18 early siddhāntas of which only a few have survived (Burgess, 1860; Shukla and Sarma, 1976). Each siddhānta is an astronomical system with its own constants. In Āryabhaṭa mathematical theory, the earth was taken to spin on its axis and the periods of the planets were given with respect to the sun.

The Sāṅkhya system describes evolution at cosmic and individual levels. It views reality as being constituted of *puruṣa*, consciousness that is all-pervasive, motionless, unchangeable, without desire who at the individual level is the *sākṣin*, the witness, and *prakṛti*, which is the phenomenal world. Prakṛti is composed of three different strands (*guṇas* or characteristics) of *sattva, rajas*, and *tamas*, which are transparency, activity, and inactivity, respectively (Larson and Bhattacharya, 1987).

Evolution begins by puruṣa and prakṛti creating *mahat* (Nature in its dynamic aspect, as energy). From mahat evolves *buddhi* (intelligence) and *manas* (mind). From *buddhi* come individualized ego consciousness (*ahaṅkāra*) and the five *tanmātras* (subtle elements) of sound, touch, sight, taste, smell. From the manas evolve the five senses (hearing, touching, seeing, tasting, smelling), the five organs of action (with which to speak, grasp, move, procreate, evacuate), and the five gross elements (ether, air, fire, water, earth) (Kak, 2001).

The evolution in Sāṅkhya is an ecological process determined completely by Nature. It differs from modern evolution theory in that it presupposes a cosmic intelligence and further beyond a universal consciousness. In reality, modern evolution also assigns intelligence to Nature in its drive to select certain forms over others as well as in the evolution of intelligence itself.

The Mahābhārata and the Purāṇas have material on creation and the rise of mankind. It is said that man arose at the end of a chain where the beginning was with plants and various kind of animals. In Vedic evolution the urge to evolve into higher forms is taken to be inherent

in nature. A system of an evolution from inanimate to progressively higher life is taken to be a consequence of the different proportions of the three basic attributes of sattva, rajas, and tamas. In its undeveloped state, cosmic matter has these qualities in equilibrium. As the world evolves, one or the other of these becomes preponderant in different objects or beings, giving specific character to each.

REALITY AND WAYS OF KNOWING

Traditionally, there were six main schools of philosophy in India, each of which had its own approach to epistemology together with accepted means of cognition. There is agreement in these schools that as consciousness cannot be reduced to material phenomena, phenomenal reality has two aspects: one of material phenomena and the other of consciousness. Reality is dual at a phenomenal level but unitary at a deeper, transcendent level.

This transcendent reality can only be approached through a variety of unique and complementary perspectives. Like the room in space with its six different walls in which each window provides a different view, Indian philosophy has six *darśanas* (visions or "schools").

The mystery of reality may be seen through the perspectives of language (because at its deepest level it embodies structures of consciousness) and logic (Nyāya), physical categories (Vaiśeṣika), analysis of creation at the personal or the psychological level (Sāṅkhya), synthesis of experience (Yoga), structures of tradition (Mīmāṃsā), and cosmology (Vedānta). Each of these ways of seeing leads to different kinds of paradox that prepares the individual for the intuitive leap to the next insight in the ladder of understanding. Partial understanding obtained from the darśanas may appear contradictory, but that is how one becomes ready for a deeper intuition.

In the Vaiśeṣika sense perception and inference are valid means, whereas in the Sāṅkhya verbal testimony or scriptural authorities are additional means, and the Nyāya accepts comparison also as a means of valid cognition. The idea is that the knowledge furnished by one means must not be attainable by any other means, it should not be reducible to another, and it should not be contradicted by another means of cognition.

The tradition of logic, which developed in the background of the Vedic theory of knowledge, was divided by the historian Vidyābhuṣaṇa into three periods: ancient (up to 400 CE), medieval (400 CE – 1200 CE), and modern (1200 CE – 1850 CE). He saw the Nyāya Sutra of Akṣapāda Gautama (or Gotama) (c 550 B.C.E.) as the foremost, if not the earliest, representative of the ancient period; Pramāṇa-samuccaya of Dignāga as representative of the medieval period; and Tattva-cintāmaṇi of Gaṅgeśa Upādhyāya as representative of the modern period. The medieval period produced many important glosses on the ancient period and much original thought. For example, Bhartṛhari (5th century CE) presented a resolution to the problem of self-referral and truth (Liar's paradox). In the modern period philosophers took up new issues such as empty terms, double negation, classification, and essences (Vidyabhusana, 1990).

Gotama, the early teacher of the Nyāya, lists four factors involved in direct perception as being the senses (*indriyas*), their objects (*artha*), the contact of the senses and the objects

(*sannikarṣa*), and the cognition produced by this contact (*jñāna*). *Manas*, mind, mediates between the self and the senses. When the manas is in contact with one sensory organ, it cannot be so with another. It is therefore atomic in dimension. It is because of the nature of the mind that experiences are essentially linear, although quick succession of impressions may give the appearance of simultaneity. Sometimes Nyāya and Vaiśeṣika are considered a single school because the later tradition of Vaiśeṣika stressed inference over material properties.

Indian epistemology acknowledges error of cognition. The final test of such theories is the application to everyday experience. Since false theories and cognitions can affect one's understanding of reality and one's response to it, a kind of a relative truth may be ascribed to them.

The Sanskrit term for epistemology is *prāmānyavāda* (literally being established by proof). It deals with *prameya* or the object of cognition, *pramā* or *pramiti* which is the cognition itself, and *pramātri* or the subject that cognizes. A distinction is made between knowledge as *jñāna*, which is experience, and representation of it as *vijñāna* that can only approximate *true* knowledge. Self-knowledge comes through intuition which stands outside the subject-object dichotomy. Understanding proceeds in a paradoxical manner by the contemplation of the self through the self or, in Sanskrit, the ātman through the ātman.

A later Nyāya philosopher recognizes four kinds of perception: sense perception, mental perception, self-consciousness, and yogic perception. Self-consciousness is a perception of the self through its states of pleasure and pain. In yogic perception, one is able to comprehend the universe in fullness and harmony (Kak, 2009).

THE VAIŚEṢIKA SYSTEM

Kaṇāda in his sutras enumerates real entities irrespective of whether they can be perceived through the sense organs or not. These are apprehensible by the mind of the observer who is central to his world. These are the building blocks of Kaṇāda's world described through their guṇas/attributes and karma/motion (Kak, 2001).

The Vaiśeṣika system has categories not only for space-time-matter but also for attributes related to perception of matter. It starts with six categories (*padārthas*) that are nameable and knowable. Nothing beyond these six fundamentals is necessary, because they are sufficient to describe everything in the universe from concrete matter to the abstract atom.

The six categories are: *dravya* (substance), *guṇa* (quality), *karma* (motion), *sāmānya* (universal), *viśeṣa* (particularity), and *samavāya* (inherence). The first three of these have objective existence and the last three are a product of intellectual discrimination. Universals (*sāmānya*) are recurrent generic properties in substances, qualities, and motions. Particularities (*viśeṣa*) reside exclusively in the eternal, non-composite substances, that is, in the individual atoms, souls, and minds, and in the unitary substances ether, space, and time. Inherence (*sāmānya*) is the relationship between entities that exist at the same time. It is the binding amongst categories that makes it possible to synthesize experience. In later descriptions of the system a seventh category of "non-existence" is added.

Of the six categories, the basic one is that of substance and the other five categories are qualities associated with the substance. Observers belong to the system in an integral fashion for if there were no sentient beings in the universe there would be no need for these categories.

There are nine classes of substances (*dravya*), some of which are non-atomic, some atomic, and others all-pervasive. The non-atomic ground is provided by the three substances of ether (*ākāśa*), space (*dik*), and time (*kāla*), which are unitary and indestructible; earth (*pṛthvī*), water (*āpas*), fire (*tejas*), and air (*vāyu*) are atomic composed of indivisible, and indestructible atoms (*aṇu*); self (*ātman*), which is the eighth, is omnipresent and eternal; and, lastly, the ninth, is the mind (*manas*), which is also eternal but of atomic dimensions, that is, infinitely small. The basic atoms of pṛthvī, āpas, tejas, and vāyu will be represented by P, Ap, T, and V, respectively. The sequence of evolution of the elements is given as V→T→Ap→P. Air is generally mentioned as the medium for the transmission of sound, but a more subtle sound that pervades the universe requires the more abstract vāyu. The ordinary molecules of matter have all the basic atoms present in them. The interactions of the atoms are governed by four different forces: P interacts with all the four, Ap with 3, V with 2, and T with 1.

Scholars of the Vaiśeṣika who wish to reconcile modern physics and the atomic elements consider these to be proton, electron, photon, and neutrino, respectively. Their logic is that since the protons (and related neutrons) provide overwhelming portion of the mass of a substance pṛthvī = proton; when electronic bonds break, the substance becomes a liquid, therefore āpas = electron; tejas (light or fire) is obviously photon; and vāyu is neutrino for it is associated with the decay of the neutron into a proton. These atoms are of different masses (m) that are correlated to their characteristics, and we can write that

$$m_p > m_{ap} > m_v > m_t$$

It is postulated that distinguishing characteristics and motion are essential for the classification of matter. Space and time are identified through motion of matter or the sun. Of the substances, four (earth, water, fire, and air) are material (that is consisting of atoms) and capable of motion whereas five others (time, space, ether, *ātman*, and mind) are non-material and, therefore, no motion may be associated with them. It is significant that ātman is listed before mind, suggesting that it is the medium through which mind's apprehensions are received. The atoms of earth, water, fire and air are different and this difference arises out of the different ways the fundamental atom of materiality combines with itself in different arrangements.

The examination of the various parts of the Vaiśeṣika system reveals that its observables arise through the effect of motion in a consistent manner. As is true of other systems, this system leads to its own paradoxes. Yet, it offers a comprehensive and scientific view of the universe beginning with gross visible matter all the way up to the subtle invisible mind.

The atom is indivisible because it is a state for which no measurement can be

attributed. What cannot be measured cannot be further divided and it cannot be spoken of as having parts. The motion the atom possesses is non-observable and it may be viewed as an abstraction in a conventional sense. Space and time are the two lenses through which matter is observed and they form the matrix of universe.

Normally, there is conservation of matter, but in extreme conditions, matter gets transformed into energy. Kaṇāda presents an opposition between *aṇu* and *mahat*, where the latter represents multiplicity or as something that pervades everywhere and may thus have been visualized as a wave.

When the universe ceases to be at the end of the cosmic cycle, matter is not annihilated; rather, it reaches a quiescent state where its atoms have no extrinsic motion and so become invisible, which appears very similar to the conception of the state of the giant atom at the beginning of cycle of creation. The lack of motion represents a cessation of time, because time is a measure of change.

In the epistemology of the Vaiśeṣika system, it is possible to obtain knowledge due to the agency of *ātman* or self. Without the self, matter by itself cannot be sentient.

We now summarize the contents of the Vaiśeṣika Sūtra of Kaṇāda, which is a book of just over 370 verses in 10 chapters, where each chapter has two sections. Calling physical law *dharma*, the first chapter defines and discusses three categories of substance, attribute, and action. The second chapter describes the nine substances. The third chapter deals with the self and the mind.

The first part of the fourth chapter speaks of the eternality of atoms and how sensory perception leads to knowledge. The second part of the fourth chapter deals with the composition of bodies. The fifth chapter deals with action, and the sixth chapter deals with the discipline that facilitates acquisition of knowledge.

The seventh chapter elaborates on atomicity and further discusses the nature of ether, mind, space and time. The eighth and ninth chapters describe various types of cognition and negation, with the latter also distinguishing between *sat* and *asat*. The tenth chapter discusses cause.

Categories, substances, and principles

Proposition 1.1. The six categories sufficient to construct the ontology of physical reality are: *dravya* (substance), *guṇa* (quality), *karma* (motion), *sāmānya* (universal), *viśeṣa* (particularity), and *samavāya* (inherence). (VS 1.1.4)

Proposition 1.2. There exist nine classes of *dravya* (substance) which are the five physical elements (earth, water, fire, air, and ether), time, space, the mind [of the observer], and consciousness. (VS 1.1.5)

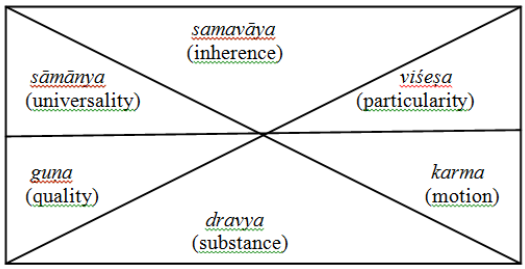

Figure 2. The six categories of Vaiśeṣika

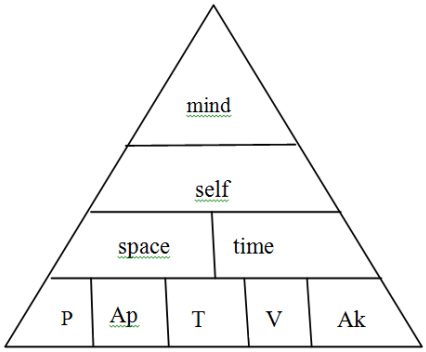

Figure 3. The nine dravyas (substances):
P: pṛthvī; Ap: āpas; T: tejas; V: vāyu; Ak: ākāśa

Ākāśa endows space with its properties of vibration, and the capacity to generate and store energy.

Proposition 1.3. The attributes (*guṇas*) associated with materiality are form, taste, odor, contact, number, measure, distinctiveness, conjunction, disjunction, otherness, non-otherness, intellect, and [internal states of the mind] such as pleasantness, unpleasantness, desire, aversion, effort, and so on. (VS 1.1.6)

The guṇas, therefore, relate to the observations made upon interaction with matter. They belong to the space of the mind. The basic measure of matter is mass.

Proposition 1.4. There exist following types of motion: rising, falling, contraction, expansion, and general motion (*gamana*). (VS 1.1.7)

Praśastapāda explains in his commentary that *gamana* includes all motions other than the four mentioned earlier. It will therefore include both displacement, rotation (*bhramaṇa*) and vibration (*spandana*). He explains that the motion at any instant is really one, but for convenience of analysis, the rotatory change of place is taken to be separate from the change of place in the downward direction.

The falling leaf driven by the wind may have rotatory and vibratory motions as well

as a vertical downward motion (patina) at the same time. Although each leaf taken separately has only one motion or change of place at one point, from the point of view of the observer (*draṣṭā*), it is convenient to speak of the rotatory change of place as separate from the displacement in the downward direction. The atoms are assumed to have a fundamental vibratory motion associated with them.

Motions not due to contact are caused by the following:

1. Volition (*prayatna*) as in the movement of the hand;
2. Gravitation as in a falling body. Brahmagupta speaks of attraction (*ākarṣaṇa*) exercised by the earth on a material body. The force of gravity may be counteracted by volition as in the holding up of the hand; or by momentum (*vega*) that keeps the flying arrow from falling;
3. Motion of fluids as in the downward flow in a stream (*syandan*). This is due to fluidity (*drvatva*) but Śaṅkara Miśra points out that fluidity is only a concomitant condition and the efficient cause remains gravity that acts on the particles in the fluid;
4. Other motions, not due to material contact, include magnetic attraction or repulsion or capillary motion; others due to final cause are called *adṛṣṭa* (unseen).

Motions due to contact include the following:

1. Motion due to direct contact with a body exercising continued pressure (*nodana*). This includes motion of an object pushed or pulled by the hand, motion of the mud under heavy stones, motion of the arrow due to pressure exercised by the bow-string, motion of the bow-string due to the pressure of the elastic bow as it recovers its original shape, motion of clouds, balloons, sailing vessels and other vehicles under the impelling force of the wind;
2. Motion due to direct contact for an instant with a body that strikes and produces an impact (*abhighāta*); so this is technically force. If there is continued contact, the result is pressure (*nodana*);
3. Motion due to direct contact with an elastic body which exercises a moving force by means of its elasticity in the act of restitution of the original form. The force of restitution in an elastic body is a kind of saṃskāra (persistent tendency);
4. Motion due to contact with a body which is itself in contact with another that possesses *vega* (momentum).

The force that produces the first motion leads to a saṃskāra (potential) or persistent tendency to motion which is the cause of the motion in the straight line. The saṃskāra is taken to last until the cessation of the motion. The force of the saṃskāra diminishes by doing work against a counteracting force and when the saṃskāra is in this way entirely destroyed, the moving body comes to rest. The *vega* (impressed motion) is counteracted by contact with tangible objects, including friction with the still atmosphere, as in the case

of the arrow. Praśastapāda says that *vega* produces work in opposition to the resisting force and thereby becomes progressively weaker until it comes to an end.

Proposition 1.5. Substance (*dravya*), attribute (*guṇa)* and motion (*karma*) are associated with properties such as eternality, temporariness, effect (*kārya*) and cause (*kāraṇa),* universality, and particularity. (VS 1.1.8)

A dravya can generate another dravya. In other words, substances are not immutable. Similarly, attributes also undergo transformation. However, dravya and guṇa cannot inter transform since they are different kinds of classes. Motion may be transformed to work within the substance through friction. The atoms have the capacity to change their molecular structure during transformation. Since space and time are dravyas, it is not surprising that neither of these is taken to be absolute.

Proposition 1.6. From motion, [new] motion is not known. (VS 1.1.11)

This is Principle 1 of the Introduction. Since in VS 5.1.17, it is asserted that one physical motion leads to another physical motion, this proposition is regarding intrinsic motion and it represents a conservation principle. To be specific, it is the conservation principle related to linear and angular momentum. The deeper intuition behind this conservation law is homogeneity of space, which is explicitly a part of Kaṇāda's system.

Proposition 1.7. Action (*kārya*) is opposed by reaction [motion: *karman*]. (VS 1.1.14)

This was presented as Law 3 of the Introduction. This law makes it possible to compute how high a ball would bounce. The ball strikes the ground with a certain force and the ground opposes this with an equal force. The force that the ball exerts on the ground is equal to and in the opposite direction as the force of the ground on the ball.

There is no explicit mention in the commentaries on how this might be of application to objects floating in water. Indians were skilled in building boats and ships and, therefore, such an extension was probably known to marine engineers.

A substance is associated with motion, attributes, and co-inherence. Motion leads to conjunction, disjunction, and motion in a substance, but it is not the cause.

Proposition 1.8. Upward motion is conjunction of gravitation and effort (force). (VS 1.1.29)

Gravitation is due to the attraction of the body by the earth, to counteract which effort is needed that makes the body travel upwards.

Proposition 1.9. In the absence of cause there is an absence of effect (kārya). (VS 1.2.1)

This is Principle 2 of the Introduction. The converse is not always true, as in the next proposition, for different kinds of causes may cancel each other.

Proposition 1.10. From absence of motion no absence of cause is implied. (VS 1.2.2)

This indicates how motions (or reactions thereof) are to be added linearly. If the addition was not linear that would imply one motion affecting another which is forbidden by Proposition 1.6. Motions can also be decomposed into components.

Proposition 1.11. The properties of universal and particular are ascertained by the mind. (VS 1.2.3)

This was presented at Principle 3 of the Introduction. This asserts that these properties are subjective. To this extent, physical theories are a construction of the mind and are a window of the deeper reality of consciousness.

Proposition 1.12. Existence is [self-defined]; substance, attribute, and motion are potential (*sattā*).

This was presented at Principle 4 of the Introduction. Although physical reality is taken to be explainable in terms of motion alone, a deeper origin of it is potential. In VS 1.2.5 it is stated that these categories are both universal and particular. The potential associated with motion is to be considered in the start of the motion, as also in the consideration of origins.

It is further stated that the property related to substance, attribute, and action arises out of their respective universals.

Praśastapāda regards karma (motion) as instantaneous in its simplest form, distinguishing it from *vega* (impressed motion, momentum) which is a persistent tendency, *saṃskāra*, and implies a series of motions.

Substances and their characteristics

Pṛthvī is taken to have the qualities of form, taste, touch, and smell; āpas has qualities of form, taste, touch, and viscidity; tejas has form and touch; and vāyu has touch. This represents a basic connection between specific objects and the corresponding qualia. The fluidity of tin, lead, iron, silver and gold arises through conjunction with tejas. The description of these qualities is to associate the modes of matter to different subjective states.

Proposition 2.1. Ākāśa does not have the measurable attributes of pṛthvī, āpas, tejas, and vāyu. (VS 2.1.5)

The element ākāśa is different from the other four elements, which have specific

measurable properties that have been mentioned in earlier sutras. Vibration is a characteristic of ākāśa, but this element is not atomic. Praśastapāda explains that there are two kinds of vibration: syllabic (*varṇa*) that represents speech, and *dhvani*, which is fundamental vibration.

In the Vedanta texts, ākāśa is the first stage in the evolution of matter from its pre-matter state. Ākāśa gives off vāyu, which gives off tejas, and on to āpas and pṛthvī. "Ākāśa (ether) itself passes through two stages before the emanation of the sūkṣma-bhūta vāyu: (1) the motionless ubiquitous primordial matter-stuff (answering to the Sāṅkhya *bhūtādi*) called *purāṇam kham*; and (2) a subtile integration, the pure un-quintiplicated sūkṣma bhūta called *vāyuram kham*, answering to the Sāṅkhya tanmātra stage. It is this subtile ākāśa, in its tanmātric integration, i.e. in the derivative form, which is subject to an incessant *parispanda*. The gaseous stage of matter (the Vedantic vāyu) is indeed matter in a state of parispandic motion. The Sāṅkhya also conceives this parispanda to characterize every process and phenomenon of cosmic evolution." (Seal, 1915, page 121) Ākāśa is therefore like the potential that exists in the vacuum from which arise other particles.

Proposition 2.2. Not inhering in [other] substances, vāyu is said to be eternal. (VS 2.1.13)

Thus the substance vāyu is used in two ways, as air, and as field. It is also taken to be additive (VS 2.1.14).

Proposition 2.3. By method of exhaustion, [vibration] is a mark of ākāśa. (VS 2.1.27)

The vibration in ākāśa can only be like a wave for such a vibration is supposed to pervade the universe.

Proposition 2.4. Existence is uncaused and eternal (*nitya*).. (VS 2.1.28)

This is Principle 5 of the Introduction. The conservation of matter is a consequence of the indestructible atoms of which it is taken to be composed.

Praśastapāda explains in his discussion of dissolution of the universe that the potential that exist in structure is exhausted and atoms fall back to their raw form. This is seen most clearly in the conception of how dissolution takes place in the Mahābhārata (Śānti Parva, chapter 233):

> When the time comes for universal dissolution, a dozen Suns begin to burn. All things mobile and immobile on Earth first disappear merging into the elements, making it shorn of trees and plants, looking naked like a tortoise shell. Then water takes up the attribute of earth element -- that is, the earth element becomes fluid. With mighty billows and roars, it pervades space. Next, water is transformed into heat. Dazzling flames of fire now conceal the Sun, and space itself begins to burn in a vast

> conflagration. Next, heat is transformed to wind, which becomes greatly agitated. In its attribute of sound, it begins to traverse upwards and downwards and transversely in all ten directions. Next, wind is transformed into space, with its attribute of unheard or unuttered sound. Finally, space withdraws into Mind. The chain continues a bit further until merging into the Consciousness, which is the ground-stuff of reality. (Ganguly, 1990)

In creation, on the other hand, pure atoms of pṛthvī etc combine to form dyads, triads, and so on, until elements as we know them are formed and gross structure of matter emerges.

Proposition 2.5. 'Close by', 'far away', 'simultaneous', 'delayed', 'quick', - such (cognitions) are the identifiers of time. (VS 2.2.6)

Time is not absolute, for it is defined in relative terms.

Proposition 2.6. That [dravya] which gives rise to such [cognition and usage] as 'this [is far away] from this,' – [is] the identifier of space. (VS 2.2.10)

Thus space is defined in relative terms, just like time. Spatial separation can only apply to matter since eternal dravyas which are incapable of motion can neither be separated nor brought together. Although mind can move, it is invisible. Therefore, all that remains in Kaṇāda's classification of dravyas is matter.

The separation is an identifier and the identification is with reference to the observing mind. It is also significant that the displacement of matter is observed relative to another piece of matter. Both space and time are characterized by their guṇa or attribute of – *paratva-aparatva* or separated versus joined.

Proposition 2.7. From true and false knowledge doubt arises. (VS 2.2.20)

All qualities except contact, disjunction, number, and separateness between two things occur in one thing at a time. Number, size, separateness, contact, disjunction, farness and nearness, weight or measure, instrumental fluidity, and impetus are generic qualities; others are specific.

Viscidity is the distinguishing characteristic of liquids, and it is responsible for cohesion and smoothness.

Cognition

Proposition 3.1. The established sensory perceptions are causes of something other than the sensory inputs. (VS 3.1.2)

This says that the perceptions are different from the actual sensory inputs (that is they

belong to another plane).

Proposition 3.2. [Knowledge] can only be grounded in existent [knowledge]. (VS 3.1.14)

Proposition 3.3. Activity and inactivity seen in [one's own] consciousness has the same mark as that of others. (VS 3.1.19)

This proposes a universal ground for subjective experiences.

Proposition 3.4. The proximity of consciousness and the objects of the senses, and the existence or non-existence of knowledge is a mark of the mind (VS 3.2.1)

Proposition 3.5. [The mind is] substantive and eternal like vāyu. (VS 3.2.2)

Proposition 3.6. From the non-simultaneity of volitions and from the non-simultaneity of knowledge one (mind is implied). (VS 3.2.3)

Proposition 3.7. [Consciousness appears] substantive and eternal like vāyu. (VS 3.2.5)

Proposition 3.8. [What] is based on the universality [of] perception, cannot be inferred in particularity. (VS 3.2.7)

Proposition 3.9. The existence of "I" (of such an intuition) in one's own consciousness and absence in others indicates the perception [of a *padārtha*] other than material. (VS 3.2.14)

Eternality, symmetry

Proposition 4.1. What is without cause is eternal (*nitya*). (VS 4.1.1)

This is a very subtle idea that sees inherent structure as a consequence of symmetry.

Proposition 4.2. The existence in the effect, [follows)] from existence in the cause. (VS 4.1.3)

The aṇu is taken to have distinct kinds of motions which, taken together with the combination of the aṇus, leads to different kinds of matter.

Proposition 4.3. [A *padārtha*] with extension is perceived from the many dravyas in it (as the substratum) and from its qualities. (VS 4.1.6)

Proposition 4.4. In spite of body and extension, vāyu is invisible owing to the absence of the

impression of form. (VS 4.1.7)

According to Praśastapāda, the class of number resides both in single things and collection of things.

Action

Proposition 5.1. In the absence of conjunction, the object falls by gravity. (VS 5.1.7)

This is Law 1 of the Introduction. Although the degree of gravitational force is not specified, the proposition implies that in the absence of gravity the object will continue to remain in its state of rest or motion.

Proposition 5.2. In the absence of a force, there is no upward motion, sideward motion or general motion (*gamana*). (VS 5.1.8)

This is Law 2a of the Introduction and absent a force the object will keep in the state of the motion.

Proposition 5.3. In an arrow, particular conjunctions cause successive motions. (VS 5.1.16)

Proposition 5.4. The arrow's initial motion is caused by force that leads to motions created by successive potentials (*saṃskāra*). (VS 5.1.17)

This is restatement of Law 2b of the Introduction. The potential lessens as the arrow loses energy to friction.

Proposition 5.5. In the absence of the potential, gravitation causes the arrow to fall. (VS 5.1.18)

Proposition 5.6. The impact of the force and the conjunction of [atoms] results in the motion of the material substance. (VS 5.2.1)

Proposition 5.7. In the absence of action, liquids flow down due to gravitation. (VS 5.2.3)

Proposition 5.8. Fluidity is the mechanism of the flow. (VS 5.2.4)

Praśastapāda explains that fluidity is of two kinds: natural (*saṃsiddhika*) and instrumental (*naimittika*). Fluidity is a natural characteristic of water. When it freezes, its natural fluidity is counteracted by the fire atoms which force the water atoms to combine to form crystals. Instrumental fluidity is at the basis of solids melting upon contact with fire. This contact causes the bonds that made the atoms from the structure associated with the solid

to get broken.

Proposition 5.9. Conjunction and disjunction of liquids [causes electricity to flow] in the clouds. (VS 5.2.11)

Proposition 5.10. The motion of the hand is explained by the action of the mind. (VS 5.2.14)

Proposition 5.11. Darkness is non-presence in the absence or the production of substance, attribute, and action. (VS 5.2.19)

Darkness is seen as absence of materiality of any kind.

Proposition 5.12. Space, time, and ākāśa are not associated with motion and [are thus] non-dynamic. (VS 5.2.21)

It has been previously mentioned that space, time, and ākāśa are non-atomic.

Proposition 5.13. The coinherence of non-dynamic entities is excluded from motion. (VS 5.2.23)

Proposition 5.14. Space is [explained by] attributes. (VS 5.2.25)

Since space is not associated by with motion, it can only be associated with attributes such as location.

Proposition 5.15. Time is [explained by] cause. (VS 5.2.26)

Since it cannot have motion, time can only be described by attributes such as relationship between events.

Chapter 6 deals with the mental states of the observer, including those that lead to enlightenment, which shall not be discussed in this article.

Universal and transforming attributes

Proposition 7.1. Specific properties like form, color, and so on, are transient properties in matter since they characterize a non-eternal substance. (VS 7.1.2)

Proposition 7.2. The [attributes] are eternal in āpas, tejas, and vāyu, since these [substances] are eternal. (VS 7.1.4)

The atoms are ordinarily indestructible. But in creation and dissolution, the atoms do

transform amongst each other and into energy.

Proposition 7.3. The recognition and non-recognition of aṇu's extension is explained in eternals. (VS 7.1.8)

Proposition 7.4. In consequence of extension [wave is produced]. (VS 7.1.9)

The *bahutvat* refers to plurality and extension which seems to correspond to that of a wave.

Proposition 7.5. The opposite of plurality is the atom. (VS 7.1.10)

This then sets up the duality of singularity and plurality.

Proposition 7.6. By these [comparisons] large and small are described. (VS 7.1.17)

Proposition 7.7. The roundness of the atom is universal. (VS 7.1.20)

Even though the atom cannot be perceived through the senses, it has to be the same from any direction or it must necessarily possess symmetry. In the conventional two or three dimensional visualization that we are used to, it is a circle or a spherical shape.

Proposition 7.8. Ākāśa and consciousness, by virtue of their expansiveness, are pervasive. (VS 7.1.22)

Proposition 7.9. In [consequence of] the absence of [extension], the mind is small. (VS 7.1.23)

Proposition 7.10. Singularity (*ekatva*) is distinct from form, taste, odor, or touch. (VS 7.2.1)

Proposition 7.11. Likewise, separateness (*pṛthaktva*) [is distinct]. (VS 7.2.2)

Proposition 7.12. There is neither conjunction or disjunction in cause and effect since they do not exist independently. (VS 7.2.13)

According to Praśastapāda, universals are of two kinds: higher and lower. A universal pervades its instances and occurs in the same form in many things, and is the source of our ideas of class inclusion, since it inheres in all its loci simultaneously.

Consciousness and mind

Proposition 8.1. Consciousness and mind are not to be seen in substances. (VS 8.1.2)

Light in Indian thought has outer and inner aspects. The outer light is generated by atoms of tejas while the inner light is a consequence of consciousness. The intuition associated with the inner light is called *jyotiṣa*. The two lights are taken to be connected. The yoga books speak of three skies which are the physical sky (*bhautika ākāśa* or *bhūtākāśa*), the sky of the mind (*citta ākāśa*), and the sky of consciousness (*cid ākāśa*). Of these, the sky of consciousness is the most subtle and powerful and it is this that engenders the connections with the other two skies. The sky of the mind is not fully illumined and its darkness that causes the individual to think that the physical sky is the primary reality.

Proposition 8.2. [The cognition of] the universal and the particular is in substance, qualities, and motion. (VS 8.1.6)

Proposition 8.3. [Cognitions arising in different] substances are not causes of one another. (VS 8.1.10)

Types of Non-Existence

Proposition 9.1. There is no reality preceding the emergence of physical motion and qualities. (VS 9.1.1)

This implies that what is identifiably is associated with motion.

Proposition 9.2. The ātmā is perceived [by the senses] when there is a particular conjunction of the ātmā and mind in the ātmā. (VS 9.1.11)

Proposition 9.3. Memory arises from the conjunction of consciousness with the mind and the stored impressions. (VS 9.2.6)

The atoms of earth, water, fire and air are different and this difference arises out of the different ways the fundamental atoms of materiality, P, Ap, T, V, combine with each other in different arrangements.

Proposition 9.3 provides the mechanism for the influence of consciousness (ātmā) on physical processes. The conjunction of the ātmā and mind is not in the physical plane and, therefore, it does not affect the material world.

We saw that Kaṇāda considers particular knowledge as being subjective and from there the relativity of time and space encountered in the Purāṇas is a small leap. It is natural to believe that these ideas had a significant influence on the work of astronomers. We now consider the specific description of relativity in the Āryabhaṭīya of the astronomer and mathematician Āryabhaṭa (born 476 CE). It is conceivable that Āryabhaṭa's idea that the earth spins on its axis was inspired by the symmetries inherent in the Vaiśeṣika.

RELATIVITY OF SPACE AND MOTION

Proposition 2.6 defined separations in time and space in local terms, not absolutely and it is to be expected that such relativity was employed in other scientific works. Āryabhaṭa is forced to consider the question of the relativity of motion explicitly in his explanation of the movement of the stars in the sky due to the rotation of the earth. For this, he uses the example of a boat from the perspectives of someone on it and on the shore. Āryabhaṭa takes it that the shift in the perspective keeps the situation on earth unaltered as far as other processes are concerned (Shukla and Sarma, 1976).

Over a thousand years after Āryabhaṭa, Galileo presented his principle as the impossibility of using "any mechanical experiment to determine absolute uniform velocity." Although there is no comparable explicit mention of this impossibility principle in Aryabhata's work, it is implicit in that the two perspectives are equivalent. Furthermore, there is explicit mention of relativity of space, and there is also mention of relativity as in the [uniform] motion of the boat, as well the [regular non-uniform] motion of the stars.

अनुलोमगतिर्नौस्थः पश्यत्यचलं विलोमगं यद्वत् ।
अचलानि भानि तद्वत् समपश्चिमगानि लङ्कायाम् ॥ ९ ॥
उदयास्तमयनिमित्तं नित्यं प्रवहेर्ण वायुना क्षिप्तः ।
लङ्कासमपश्चिमगो भयञ्जरः सग्रहो भ्रमति ॥ १० ॥

> Similar to a person in a boat moving forward who sees the stationary objects on the bank of the river as moving backwards, the stationary stars at Laṅkā (equator) are viewed as moving westwards. /
> An illusion is created similarly that the entire structure of asterisms together with the planets is moving exactly towards the west of Laṅkā, being constantly driven by the provector wind, to cause their rising and setting. ■

The first stanza acknowledges that the felt experience remaining unchanged if the motion is uniform. In the second stanza, by speaking of illusion, Āryabhaṭa is explaining that similar to an observer in a moving boat, observers on earth feel that everything outside the planet moves from east to west. In fact, it is the earth which moves circularly from west to east resulting in the sun rise and sun set. This is relative motion that is collectively observable from the non-stationary earth.

Āryabhaṭa extends relativity of motion as experience on a boat to rotational motion of the stars, which is a significant generalization from terrestrial to astronomical phenomena. Furthermore, whereas his reference to the motion of the boat suggests uniform motion, his reference to the motion of the stars includes rotational motion.

Relativity of space

Āryabhaṭa takes Earth as a spherical planet suspended in space surrounded by numerous stars. It is always darker on one half which is the half that is facing away from the sun and this darkness is a consequence of its own shadow. He describes how the relationship between the latitude and the time of the day varies; stating further what is clock-wise in the North Pole is anti-clockwise in the South Pole. He adds that residents of the North and the South Pole consider each other as mutually being below each other. In doing so, Āryabhaṭa is asserting the relativity of space.

स्वर्मेरू स्थलमध्ये नरको बडवामुखं च जलमध्ये।
अमरमरा मन्यन्ते परस्परमधःस्थितान् नियतम् ॥१२॥

Heavens and the Meru mountain are at the center of the land (i.e., at the North Pole); hell and the Badavāmukha are at the center of the water (i.e., at the South Pole). / The gods [residing at the North Pole) and the demons [residing at the South Pole] consider *themselves positively and permanently below each other.* ■

Time and velocity

भक्ते विलोमविवरे गतियोगेनानुलोमविवरे द्वौ ।
गत्यन्तरेण लब्धौ द्वियोगकालावतीतैष्यौ ॥३१॥

Divide the distance between the two bodies moving in the opposite directions by the sum of their speeds, and the distance between the two bodies moving in the same direction by the difference of their speeds; the two quotients will give the time elapsed since the two bodies met or to elapse before they will meet. ■

The velocity of a moving body on earth as a function of distance and time is described in this verse. But this is the same as that for a moving body on a stationary earth. Therefore, it is conclusive that Āryabhaṭa recognized that laws of motion remain the same irrespective of the motion of the reference frame.

Āryabhaṭa states that observers on earth do not experience their own rotational motion, observers away from the earth will detect although a westward motion. Implicitly, the laws of motion remain the same for moving objects on earth. This does sum up to the position that regular motion can be detected only by observing the system from another reference frame.

TRANSFORMATION AND EVOLUTION

The process of transformation and evolution is described conceptually in the Sāṅkhya system. The physical world is Prakṛti, which is energy in a continuum of undifferentiated qualities

(guṇas), called sattva, rajas, and tamas. Sattva serves as the medium for the reflection of intelligence; rajas, energy, is characterized by a tendency to do work and overcome resistance; and tamas, mass or inertia, counteracts the energy of rajas to do work and of sattva to conscious manifestation. The infinitesimals of sattva and rajas are not material particles, but rather non-material fields.

The guṇas are always interacting with each other in different ways and it is their mutual interaction that produces the material world with its evolving structure. Seal summarizes: "The particular guṇa which happens to be predominant in any phenomenon becomes manifest in that phenomenon, and the others become latent, though their presence is inferred by their effect. For example, in any material system at rest, mass is patent, energy is latent, and conscious manifestation is sub-latent… Evolution in its formal aspect is defined as differentiation in the integrated. In other words, the process of evolution consists in the development of the differentiated within the undifferentiated, of the determinate within the indeterminate, of the coherent within the incoherent. The evolutionary series is subject to a definite law which it cannot overstep… The guṇas, though assuming an infinite diversity of forms and powers, can neither be created nor destroyed." (Seal, 1915, pages 5-7) This conservation of guṇas is an additional principle of relevance to transformation of matter.

The Sāṅkhya evolution of matter starts with undifferentiated mass (*bhūtādi*), which is inert. Next comes tanmātra which represents subtle, vibratory matter with potential energy. Tanmātras are not atoms with specific gross properties. Rather, they are the potentials of energies represented by sound, touch, color, taste, and smell.

Vyāsa, the commentator on the Yoga Sūtra, says this about time: "Even an atom has constituent parts (tanmātras), and hence an atom must take more than one moment to change its position. The moment of that which is absolutely simple and without parts from one point in space to the next must be instantaneous, and conceived as the absolute unit of change (and therefore of time, *kṣaṇa*). If this is held to be an irreducible absolute unit, it will follow that what we represent as the time-continuum is really discrete. Time is of one dimension. Two moments cannot co-exist; neither does any series of moments exists in reality. Order in time is nothing but the relation of antecedence and sequence, between the moment that is and the moment that just went before. But only one moment, the present, exists. The future and the past have no meaning apart from potential and sub-latent phenomena… Only one single moment is actual, and the whole universe evolves in that single moment. The rest is potential or sub-latent. (Seal, 1915, pages 19-20)

In Vyāsa's view, the sound-tanmātra, with accretion of bhūtādi, generates vibrations in ākāśa; the touch tanmātra combines with the sound-tanmātra to generate the vāyu-atom; the fire tanmātra together with the sound and touch tanmātras generates the fire-atom; the taste tanmātra together with the sound, touch, and fire tanmātras generates the water-atom; and the smell-tanmātra together with the preceding other tanmātras generates the earth-atom.

Thus, observers influence nature by the process of observation (*dṛṣṭi* in Sanskrit). This is very similar to the quantum mechanical view of the influence of observation on a physical process by the quantum Zeno effect (Kak, 2004). But the difference between quantum theory

and Indian ideas is that although one speaks of observations in quantum theory there is no place in its ontology for observers. Schrödinger was aware of this limitation of quantum theory and he argued that sense-categories like the tanmātras of the Sāṅkhya system of creation at the individual or the cosmic level were essential to understand reality.

In traditional Indian art, Śiva (representing individual and universal consciousness) is shown as lifeless next to the vibrant Goddess (who represents Nature). Abstract representations of the cosmos show Śiva as a dot (of immateriality) within the (geometric) framework of the material world. Much of Indian mythology is an exposition of Indian physics in a coded language.

Indian epistemology has some parallels with Western idealism that accepts independent existence of ideas and forms. But it is different in the sense that the self has access to much more than what the individual obtains through the sense organs due to the pervasive character of the self at the individual level (*ātman*) or in its totality (*brahman*). The counter-intuitive notion of equality between the two selves makes it possible to see how large scale correlations can exist and how a person can obtain surprising insights through intuition. Naturally, such insights can only be rationalized within the framework of the individual's knowledge. Although ordinarily consciousness and matter are two distinct categories, consciousness can influence the evolution of matter through observation.

ATOMS AND MOLECULES

Atoms possess incessant vibratory motion. Heat and light rays consist of very small particles of high velocity. As material particles, their velocity is finite. This is also due to the fact that motion is contingent upon time as one of the dravyas. Heat and light particles penetrate through inter-atomic spaces, and their rays through a transparent medium get deflected or refracted. Particles of heat and light can be endowed with different characteristics and heat and light can be of different kinds. The atoms of light and heat belong to the tejas category; there are four other kinds of atoms with attributes.

There is no difference between the atom of a barley seed and paddy seed, for both these are constructed out of the atoms of earth. Under the impact of heat particles, atoms exhibit new characteristics. A *bhūta*-atom evolves out of integration from the corresponding *tanmātra*, which is its potential form, indicating a primacy of the abstract over the material. Although atoms are unitary objects their combinations generate various tanmātras. Combinations of rudiment-matter (*bhūtādi*) lead to more specific forms. The vibrations of atoms increase and change when acted upon by energy. Every molecule contains at least one atom of all four types, and obtained its character from the predominance of a given element. This makes it possible to see how molecules may show characteristics of more than one element and they might also burn or become liquid.

The atom's potentiality manifests in distinct attributes based on state of conjunction and motion. It is this potentiality that leads to diverse complex atoms with different attributes. These attributes may be viewed as being created by the matrix of space, time and number. Light has a special place in this view as it is both an elementary constituent of matter as well

as the medium that shines the inner space of the mind. The atom of light cannot be described fully.

To conceive positions in space, Vācaspati Miśra takes three axes: one from east to west, second from north to south, and a third up to the meridian position of the sun, anticipating three-dimensional solid geometry. He speaks of a lattice arrangement of atoms where each is in contact with six others.

Ākāśa has not atomic structure and is inert, being posited only as the substratum of sound, which is supposed to travel wave-like in the manifesting medium or vehicle of vāyu. Pṛthvī, āpas, tejas, and vāyu atoms are possessed of characteristic properties of mass, fluidity, and so on. These atoms unite in atomic or molecular forms.

One atom may combine with another to form a binary molecule with inherent *parispanda* (rotational or vibrational motion). The binary molecules combine by threes, fours, fives, and so on to form larger aggregates and a variety of elementary substances.

A triad holds together three atoms, not three binary molecules. An elementary substance may suffer qualitative change under the influence of heat particles. One scholar (Gaṅgeśa) suggests that even gold can evaporate by application of intense heat. Chemical combination takes place either between two or more substances that are isomeric modifications of the same bhūta, or between substances which are modes of different bhūtas.

Praśastapāda describes a scheme in which molecules combine to form a compound (Figure 4). The atom's potentiality manifests in distinct attributes based on state of conjunction and motion. It is this potentiality that leads to diverse complex atoms with different attributes. These attributes may be viewed as being created by the matrix of space, time and number. The forces are mediated by atoms of one kind or the other.

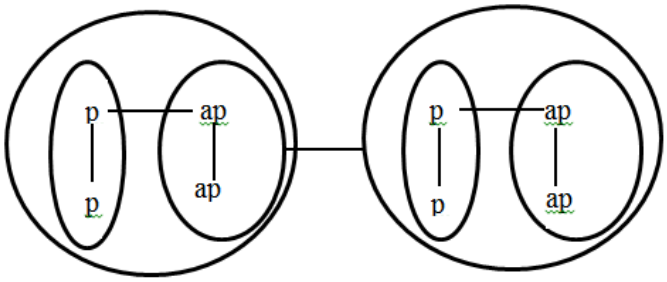

Figure 4. Molecules of a compound (p=earth atom; ap=water atom) (after Seal, 1915)

Other scholars argue that for two atoms to come together to form a molecule the linkages between the two should be in terms of attraction based on opposite attributes. Electricity and magnetism as well as light were seen to be a property of tejas atoms.

ACOUSTICS AND MUSIC

In their analysis of sound, the Indian tradition distinguishes between three types: *nāda, dhvani,* and *sphoṭa*. Nāda is the physical basis of sound, dhvani is the audible sound, and sphoṭa is the idea behind the sound. Śabara (c. 300) and Kumārila Bhaṭṭa (c. 700) of the Mīmāṃsā School speak clearly of how the vibration of collections of air molecules produces

audible sound. Bhartṛhari (5th century) in his Vākyapadīya describes sounds as arising out of the pressure waves related to variations in velocity and configuration.

The vibrating air molecules at the source of the sound suffer a deviation from their usual motion that generates a saṃskāra which transfers this vibration to neighboring molecules in succession so that the sound wave travels out and the energy of this dissipates with distance. Such a saṃskāra may be viewed from the perspectives of elasticity as well as momentum from an impressed force. Some writers state that elasticity is one of the causes of vibration and it resides in all the four atomic elements (earth, water, fire, air). Such elastic property will explain how sound can travel in solids and liquids.

Echo (*pratidhvani*) was seen in the same manner as image in a mirror (*pratibimba*). Sounds differ from one another in their pitch (*tāramandādibheda*), intensity (*tīvramandādibheda*), and timbre (*asādhāraṇa dharmma*).

In one view, cosmic sound as nāda is the cause of the material universe and it is identified with the Brahman of the Upaniṣads. Nāda is synonymous with parā vāk, and it comes in two forms: āhata (perceptible sound), and anāhata (unstuck or absolute sound). Music is the elevated form of ahata nāda whereas anāhata nāda can be cognized only through Yoga.

Indian musical tests tell us that 22 śrutis span the seven notes of the octave. In the Shadjagrāma scale, the seven notes are at intervals of 4, 3, 2, 4, 4, 3, 2 śrutis, and it is not clear why the division is into groups of four, three, and two into the seven musical notes (Nijenhuis, 1974). It is possible that the division began with equal śrutis, to the extent possible) and the notes were shifted somewhat to provide richness. It was known that the pitch of a note is inversely proportional to the length of the wire. It was known that the pitch of the fundamental note to that of its octave is 1:2, that of the fourth to the fundamental is 4:3, and that of the fifth to the fundamental is 3:2.

OVERVIEW OF CHEMISTRY

Indian chemistry developed many different alkalis, acids and metallic salts by processes of calcination and distillation, often motivated by the need to formulate medicines. The idea of molecules that combine by the joining of basic atoms of four kinds in different combinations at the basis of the formulations must have informed the chemist. The development of chemistry was essential for pottery, building materials, metals, jewelry, glass, dyes, perfumes, and medicines in the Sindhu-Sarasvati tradition. Further elements were the requirements of Āyurveda, which used a variety of plant-based chemicals and also minerals. The various phases in the development of chemistry in India are described in P.C. Ray's classic work (Ray, 1909).

The Vedic books mention gold, silver, iron, lead, copper, bronze, and tin, amongst others. The Chāndogya Upaniṣad 4.17.7 has the passage "one binds gold by means of lavaṇa (borax), and silver by means of gold, tin by mans of silver, lead by means of tin, iron by means of lead, and wood by means of iron and also by means of leather."

The Āyurvedic doṣas (humors) correspond to the elements water, fire, and air, and,

therefore, this classification is a subset of the five Vedic mahābhūtas. Both Caraka and Suśruta Saṃhitās lists hundreds of medicinal plants, and dozens of preparations based on mineral and animal sources. Another source is the Nāvanītaka (Bower Manuscript) that also has recipes of hair dyes which use a number of plants like indigo and minerals like iron powder, black iron or steel and acidic extracts of sour rice gruel.

Medicines were chiefly derived from plants, although a few ingredients originated from animals. Preparations of medicines involved collection of the ingredients, their purification, and extraction of their essences and compounding of these extracts by means of processes like grinding, pasting and maceration. Processes like dissolution, distillation, sublimation, precipitation, combustion, dilution and decocting were carried out in these preparations. The word *khola* (most likely the source for the corresponding Arabic word) is used for alcoholic beverages. Mercury and gold were also used in a number of drugs.

Early invention of distillation must have helped production of metals by this process. India was the first in designing retorts, which could control distillation of such a volatile metal as zinc. In fact, for the medieval times zinc production reached industrial scale levels. Zinc was extracted in India as early as 10th century BCE and finds mention in the Arthaśāstra. Ancient northwestern India is the first region that produced zinc on an industrial scale.

In the area of smelting metals, Indians had acquired proficiency in the extraction of metals from ore, and also in the casting of metals. The copper-bronze metallurgy in the third millennium BCE was widespread and of high quality. Lothal copper is unusually pure, lacking the arsenic typically used by coppersmiths across the rest of the Sindhu-Sarasvati valleys. Workers mixed tin with copper for the manufacture of different tools. Casting was based on the lost-wax technique, and it used more than one for casting birds and animals. Tools such as curved saws and twisted drills, unknown to other civilizations at the time, were used.

Excavations in Middle Ganga Valley show iron working in India began as early as 2800 BCE (Tiwari, 2003). High quality steel was produced in southern India by the crucible technique perhaps as early as 300 BCE. In this system, high-purity wrought iron, charcoal, and glass were mixed in crucibles and heated until the iron melted and absorbed the carbon. The resulting steel, called wootz by Europeans, was exported throughout much of Asia and Europe.

The Iron Pillar at Delhi is an example of the proficiency Indians had in the extraction and processing of iron. This Pillar is estimated to have been cast about 1500 years ago. The Pillar is 7.2 metres in length, tapering from a diameter of 420 cms at the base to 31 cms, at the top and it weighs about 6 tonnes. It is believed to have originally been erected in Udayagiri in approximately 402 CE, and it was transported to its current location in 1233 CE. Such rust-proof iron had not been smelted anywhere else in the world, till stainless steel was invented a few decades ago. The pillar was manufactured by the forge welding of pieces of wrought iron. The pillar's resistance to corrosion is due to a passive protective film at the iron-rust interface and high amounts of phosphorus in the metal.

Another instance of Indian metallurgy is the copper statue of Gautama Buddha found

at Sultanganj in Bihar and dated to about 500-700 CE. The statue is 2.3 metres high and weighs over 500 Kg. It was cast in pure, but unrefined copper, by the lost-wax technique. The ironsmiths who cast the iron pillar and the statue of Buddha most likely inherited the technique that had been perfected over many generations.

Nāgārjuna (born 931 CE) was a chemist, or an alchemist, as his efforts were concentrated on transforming base metals into gold. In his treatise, Rasaratnākara, he describes the extraction of metals like gold, silver, tin and copper from their ores and their purification. Later he turned towards organic chemistry and medicine. He wrote a text called Uttaratantra as a supplement to the Suśruta Saṃhitā for the preparation of medicinal drugs.

The Bṛhat Saṃhitā of Varāhamihira, in the chapter called *Gandhayukti,* presents recipes for making scents. It gives a list of eight aromatic ingredients used for making scents. It describes a matrix (*ārṇava*), wherein using 4×4, i.e. total 16 ingredients, choosing any 4 of them along any row, column or diagonal and permuted variously at will and that in one, 2, 3 or 4 parts provide 1,820 different compositions of perfumes.

A verse in the Sanskrit alchemical text Rasopaniṣada narrates the preparations of a gunpowder mixture. Śukrācārya's *Śukra-nītisāra* mentions gun and gunpowder. It also gave a recipe for a gunpowder mixture consisting of saltpeter, sulphur and charcoal in specific proportions.

CONCLUDING REMARKS

The examination of the various parts of the Vaiśeṣika system reveals that its observables arise through the effect of motion of atoms in a consistent manner. Although the framework of the Vaiśeṣika has limitations, it offers a comprehensive and scientific view of the universe beginning with gross visible matter all the way up to the subtle invisible mind. Specifically, it deals with motion, laws and symmetries, atoms and molecules, transformations and evolution. It argues that molecules can inter-transform and amongst the effects it describes is that of electricity and magnetism. It was presumed that the tejas atoms were at the basis of the electric and magnetic phenomena.

The atom is indivisible because it is a state for which no measurement can be attributed. What cannot be measured cannot be further divided and it cannot be spoken of as having parts. The motion the atom possesses is non-observable and it may be viewed as an abstraction in a conventional sense. Space and time are the two lenses through which matter is observed and they form the matrix of universe. The distinction between intrinsic and extrinsic motions arises from the fact that intrinsic motion is uniform in all directions.

When the universe ceases to be at the end of the cosmic cycle, the transmuted matter reaches a quiescent state in which there is no extrinsic motion and so it becomes invisible; this appears very similar to the conception of the state of the aggregate of atoms at the beginning of cycle of creation. The lack of motion represents a cessation of time, because time is a measure of change.

In the epistemology of the Vaiśeṣika system, it is possible to obtain knowledge due to the agency of ātman or self. It is striking that in spite of its limitations, it is of contemporary

interest for it includes observers and the idea of consciousness. Modern physics has grappled with the problem of observers, but without much success, as attempts to see consciousness as emerging out of complexity of neural structures do not explain why and how it emerges.

Scientists are generally agreed that the absence of sentient observers in the conception of science means that it is an incomplete picture. The consideration of minds and consciousness as a starting point of the Vaiśeṣika system is conceptually attractive.

To get an idea of how the physical and chemical sciences were applied to solve real world problems, one must mention the polymath King Bhoja of the Paramāra Dynasty who ruled a large part of the India subcontinent from 1000 or 1010 to 1055. In the Rasa-Rāja-Mṛgāṅka, he addresses the extraction of metals from ores and the production of various drugs; in the Samarāṅgaṇa Sūtradhāra, he speaks of construction of buildings, forts, temples, images of deities and mechanical and hydraulic devices including gliders; in the Yukti Kalpataru, he mentions ship-building and weapons amongst other topics.

India was the world's leading nation in science before the Middle Ages. Indian technology was flourishing before the arrival of the British. It is estimated that India's share of world trade in 1800 was about 20 to 25 percent. Abraham Parsons, a British traveler, described India's shipbuilding prowess in 1775: "Ships built at Bombay are not only as strong, but as handsome, are as well finished as ships built in any part of Europe; the timber and plank, of which they are built, so far exceeds any in Europe for durability that it is usual for ships to last fifty or sixty years; as a proof of which I am informed, that the ship called the Bombay grab, of twenty-four guns, (the second in size belonging to the Company's marine) has been built more than sixty years, and is now a good and strong ship."

Here's an assessment of shipbuilding by the historian Dieter Schlingloff: "The ancient Indian merchant ships differed from the Roman merchant ships in one respect, namely in their multiple masts. While in the entire European area the ships only possessed a single mainsail (and at best a fore-and-aft sail) right up to the late Middle Ages, in India two, and later three sails were common. Of course the home territory of the Indian seafarers was not an inland sea like the Mediterranean, but the Indian Ocean. Hence they developed a sophisticated system of sails which in number of sails was only matched and surpassed by the explorers' ships of the I5th century."

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Proof of the Existence of God*

INTRODUCTION

I recently published papers [1][2] that may be viewed as proof for the existence of God. Since this is a matter of much interest to the layperson, I provide a summary.

Let me first explain what I mean by "God". I don't mean someone who sits in paradise and watches over the world, meting out punishment or reward on the Day of Judgment. Such suppositions are not subject to refutation, and are outside scientific and rational argumentation. (I will at the end of this essay explain the etymology of the words "God" and "paradise" and explain how they relate to the understanding I use.)

GOD AND CONSCIOUSNESS

By "God", I take its Vedic meaning, that it is the Self (*ātman*) within each individual. The Śiva Sūtra proclaims *caitanyamātmā*, or "Consciousness is the Self" [3]. It is elsewhere called Śiva, and explained as *Prakāśa* or Light. This is as in Aitareya Upaniṣad with its प्रज्ञानम् ब्रह्म, *prajñānam brahma*, or Māṇḍūkya Upaniṣad's अयम् आत्मा ब्रह्म, *ayam ātmā brahma*, or "This Self (ātman) is brahman". The Bhagavad Gītā calls the inner Self "Maheśvara" (5.29), the Great Īśvara, another name for Śiva, which literally means the "Great Lord".

The Vedic view is that the individual selves (as experienced by different minds) are like the images of the one Sun in different pots of water; the difference that is experienced is not because the light is different but that it has been received in pots with different screens. Instinct and habit throw covers on the light resulting in a spectrum of felt experience.

In all scientific theory, and in our meditations on the world, the observer (consciousness) is outside the physical universe.

The physical universe is experienced within consciousness.

If consciousness is a property of the physical reality, then there is no God.

The proof that God exists is to show that consciousness cannot be derived from materiality. If it were a property of matter, one could measure it. As property of matter, it would be subject to diminution or expansion and determined by the past, whereas in reality consciousness is associated with freedom.

We live in the age of computers, so let us restate this problem in terms of whether

* Summary of two papers: Journal of Artificial Intelligence and Consciousness 9, 59-72, 2022 & Journal of Artificial Intelligence and Consciousness. 2022

computers will ever become conscious.

If computers cannot become conscious (not just now but ever in the future), then consciousness is distinct from materiality and this is proof of the existence of God.

Put differently, if consciousness is not computable then God exists. Materiality and consciousness are then two aspects of the same reality, like two sides of a coin.

CONSCIOUSNESS IS NOT COMPUTABLE

In "The limits of machine consciousness" [1], I show that while science can explain mind/intelligence (I call this Little-C), it cannot explain Consciousness (this I call Big-C; which is equivalent to Śiva). I use arguments from neuroscience, logic, and quantum theory to arrive at my conclusions.

Big-C, or Consciousness, transcends the materialism paradigm, and it is consistent with Vedanta.

> We think of ourselves as being outside of the physical world. Even our conceptions of the universe are as if we are not a part of it. Our bodies belong to it but not our minds.
>
> If this sense of being outside of the physical world is true, it would be impossible to emulate it by hardware and processing that is within the world. It also follows that it will not be a computational property of the physical elements that comprise the system.
>
> If consciousness is not material, it cannot be local, and thus it must be non-algorithmic and non-computable.

Consciousness has many paradoxical aspects. Thus in the framework of quantum theory has the observer sit outside the system with the capacity to collapse its state, while remaining unaccounted by the theory. The paradoxes of consciousness are a consequence of its manifestation in the mind, which has limitations of time and space. Note also that logic is associated with its own paradoxes.

We can look for the non-computability of parallel to the unsolvability of the halting problem of computer science. Let us define "consciousness" as some privileged state of the mind that makes its processes halt (we don't bother to specify it beyond this description) and its contents registered (which is what we imply by awareness).

Humans can get into the state of "awareness" at any time, which means that the earlier computation has halted, and this is irrespective of the initial state of the immediately preceding process. (The exceptions to this are if a person is sleeping or unconscious as in coma.)

But such halting to arbitrary input is impossible from a computability point of view. Therefore, it follows that consciousness is not computable.

The consideration of information (or entropy) in physical theory, which is commonly

done in many branches of physics, implies an unstated postulation of consciousness.

Information cannot be reduced to local operations by any reductionist program. It requires the use of signs derived from global properties and the capacity to make choices which, in turn, implies agency or freedom.

LAYERS OF REALITY

Apart from the physical substratum of reality, there are additional categories that play a role in the workings of the mind, and they are called *tattvas*. The flow of consciousness may be seen in an ecological setting as adaptation to the environment. Therefore, consciousness should sit on top of various kinds of cognitive components associated with reality that bridge down to physical elements.

Traditionally, these components are called *tattvas*, and they have been seen to equal 25 (5 gross elements of earth, water, fire, air, and *ākāśa*; 5 subtle elements, *tanmātras*, associated with smell, taste, form, touch, and sound that help one apprehend the gross elements; 5 organs of action that is excretion, procreation, locomotion, grasping, and speaking; 5 senses of smell, taste, sight, touch, and hearing; mind; ego; intelligence; *prakṛti*, Nature; and *puruṣa*, undifferentiated consciousness).

There are an additional 11 tattvas, related to veiling and unveiling of consciousness (called the Rudras in the Vedas), for a total of 36 in Śaivism.

	puruṣa		*prakṛti*		
	intelligence	ego		mind	
Sense organs	smell	taste	sight	touch	hearing
Action organs	excretion	procreation	locomotion	grasping	speech
Tanmātras	smell	taste	form	touch	sound
Elements	earth	water	fire	air	ākāśa

Figure 1. The 25 *tattvas* of Sāṅkhya

Manifestations of Consciousness	*Śiva* Pure consciousness	*Śakti* Manifestation as	*Sadāśiva* Appearance of Self	*Īśvara* Self-awareness	*Sadvidyā* Balance of Self & objects
Veiling of Māyā	*kāla* limitation of time	*kalā* limitation of action	*niyati* limitation of causality	*rāga* limitation of attachment	*avidyā* limitation of materiality

Figure 2. The 11 *tattvas* associated with consciousness

My companion paper in the same journal titled “Number of autonomous cognitive agents in a neural network” shows that this number, which may be taken to equal the *tattvas*, is 25, and that the brain's structure is optimal.

LITERAL MEANING OF "GOD" AND "PARADISE"

What I mean by "God" is its literal meaning, traced to the Sanskrit original "*svatavas*" meaning "*self-strong*", which is attested in the literature. In the Vedas, we have *tavas* तवस् (a. strong, great; -n. strength, power) and in the Ṛgveda 3.1.1 सोमस्य मा तवसं वक्ष्यग्ने. The meaning of "free" for "svatas" is attested in दातव्यं बान्धवै- स्तत्स्यात् प्रविभक्तेरपि स्वतः in Manu Smṛti 8.166.

Just as the Sanskrit *svar* ("sun") of the Ṛgveda, becomes *xwara* of Avestan and *khar* of Persian, the word स्वतव, *sva-tava* (self-powered) became *xwatāw* in Avestan, and *xudā*, and *khudā* in Farsi, and via Iranians became German *Gott* and English *God*.

The original meaning of "God" is "self-powered" and "free" (that is independent of materiality) aspect of Consciousness. The word "*paridhāyas*" परिधायस् (sustaining, supporting all around) which via its Avestan derivative "pairi-daiza" = around wall = enclosed garden is the basis of the word "paradise", means the space that is characterized by inherent freedom.

This is precisely the Vedic conception of God proclaimed forcefully by Krishna in the Bhagavad Gītā as ātman that is *ajo nityaḥ śāśvataḥ* (unborn, eternal, immortal, BG 2.20) and in the Śaiva tradition, which asserts that each person is Śiva, as in the Sanskrit slogan *Śivoham* (I am Śiva).

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