A MODERN SCIENTIFIC INSIGHT OF *SPHOTA VADA*: IMPLICATIONS TO THE DEVELOPMENT OF SOFTWARE FOR MODELING NATURAL LANGUAGE COMPREHENSION

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Sabdabrahma Siddhanta, popularized by Patanjali and Bhartruhari will be scientifically analyzed. *Sphota Vada*, proposed and nurtured by the Sanskrit grammarians will be interpreted from modern physics and communication engineering points of view. Insight about the theory of language and modes of language acquisition and communication available in the *Brahma Kanda* of *Vakyapadeeyam* will be translated into modern computational terms. A flowchart of language processing in humans will be given. A gross model of human language acquisition, comprehension and communication process forming the basis to develop software for relevant mind-machine modeling will be presented. The implications of such a model to artificial intelligence and cognitive sciences will be discussed. The essentiality and necessity of a physics, communication engineering, biophysical and biochemical insight as both complementary and supplementary to using mathematical and computational methods in delineating the theory of Sanskrit language is put forward. Natural language comprehension as distinct and different from natural language processing is pointed out.

**Key Words:** Sabdabrahma Siddhanta; sphota vada; natural language comprehension; flowchart and software of human language acquisition and communication; artificial intelligence; cognitive sciences; physiological psychology

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Introduction:

Ancient Indian wisdom as revealed in the *Upanishads* has a lot to say about human consciousness and mental functions [1-14] The expressions of the *Upanishads*, when translated into the modern scientific terms will benefit the fields of physiological psychology; the natural language comprehension branch of artificial intelligence, and the modeling of human cognition, language communication and understanding processes [2-14]. A physics and communication engineering model of human language acquisition and communication based on *Upanishadic* expressions and *Sabdabraham Siddhanta* is presented here. *Brahma Jnana* or *Atma Jnana* is the basis of both *Vedanta* and *Sabdabraham Siddhanta* [12-20].

Concept of mind as available in *Atma- or Brahma- Jnana/ AdvaitaPhilosophy*:

*Atman* or *Brahman* is *Sat-Chit-Ananda* (See Concept diagrams I to III)

**Adi Sankara:**

*Brahma sat jagat mithya jivo brahma eva na apraha*

*What is present always (in dristi and responsible for formation of dristi) is Brahman and jagat (which is moving or transient) is adhyasa (veil), over sat (Brahman); and mithya (unreal or virtual); jiva (self-consciousness or egoistic state of mind as adhyasa over Brahman) is Brahman (pure consciousness or unoccupied awareness) Itself, not different or separate.*

*Atman* (yasya gamanam satatam tat atma) and *maya* (yaya asantam pasyati sa maya or ya ma sa maya) together constitute and compose of human consciousness and are the ingredients that construct and operate human consciousness and human mental functions\(^5\). *Maya* (reflection of *atma sakti* or *chit sakti* in *medha* as *chidaabhaasa*) as *tamas* (i) conceals the *atmachaitanayam*; (ii) falsely identifies the individual with self-consciousness and forms ego - which are also part of inner mental world (*jagat*) by forming veil (*adhyasa*); thus causes (iii) *moham* and makes one see and experience *jagat* as *sukti-rajata-bhranti*; or *rajju-sarpa-bhranti* as *avidya* and (iv) makes *vidya* disappear from awareness (*dristi*); and (v) is transient, transitory and illusory reflection of *sat*.

Because of these five kinds of illusions caused by *maya*, all inner mental world and mental functions (*prapancham* or *jagat* or *viswam* and *self-consciousness*) therein transpose themselves on *Atman* as pictures are superimposed on the cinema screen. *Atman* is like the cinema screen here. These pictures (cognitions, cognition related experiences, senses, meanings and self-consciousness) appearing on *Atman*-screen do not and can not separate themselves from the screen and require the screen for their appearance, cognition and sustenance.

All this is termed as *mithya* till the mental awareness becomes pure-consciousness and once this Truth becomes the *dristi* (conscious awareness), all these cognition and ego related-appearances are termed not separate from *Atman* but as part and parcel of *Atman*. *Dristi* (conscious awareness) is important. Just as waves are not separate from the sea so are the appearances as *sriti* (mental cognitions and self-consciousness) are not separate from *Atman*. (See also Concept Diagrams I, II and III)
Inner mental world (idam) and mental functions (jagat):

*Vedanta Panchadasi*: Asti bhaati priyam namam roopamcheti amsa panchakam

**Adya trayam brahma roopam tato dwayam jagat roopam**

is a famous expression of *Vedanta Panchadasi* by Vidyaranaya. This sloka says that prapancham (also known as viswam) is made up of five ingredients: asti (sat aspect), bhaati (chit aspect), priyam (ananda aspect)- the aspects of Brahman or Atman, namam (name) and roopam (form or sight or drusyam or vishaya), the aspects of prapancham or jagath or jiva. Addition or tagging of namam and roopam to Atman forms prapancham in jada (potential) form. Prapancham becomes jagat (kinetic/dynamic) when retrieved and appears in the dristi. These namam and roopam also consist of words and forms we cognize and learn while learning languages, disciplines and skills and all kinds of knowledge.

In jagat, Atman is in three parts as asti – the sat aspect; bhaati – the chit aspect and priyam – anandam aspect, together with the two parts namam (name) and roopam (form). Namam is given by language and form is what the vishaya looks like or cognized like. It must be noted here that prapancham is created within as sensed by sense organs through the antahkarana manas. So obviously the smells (by nose), tastes (by tongue) and touches and feelings of hotness and coldness (through skin) are also part of prapancham in addition to sounds heard by ears and forms seen by eyes. This prapancham will be in jada (potential) form and becomes jagat as kinetic form when retrieved and perceived by manas forming thoughts/feelings etc., (See concept Diagrams II to V)

Consciousness is non-dual (advaita) awareness. It is experience as bliss/peace/silence when self-consciousness is absorbed or got absorbed in pure consciousness. Consciousness is also experience when no cognitions or cognition-related experiences are in the awareness of mind. Experienced awareness is consciousness. Awareness of nothing within or without the body is consciousness. It is peace, bliss and silence. Mind is dual (dvaita) awareness. Knowing, perception, thinking, doing intellectual operations, discrimination, feelings, having moods, urges, intuitions, understanding, getting and having insight, experiences are functions of mind.

**Scheme of human mental acquisitions, functions and communications:**

While mind is functioning, there will be a differentiated perception of knower-knowing-known or subject-verb-object, which will be missing and absent when non-dual (advaita) awareness or pure consciousness becomes unoccupied awareness [2-14]. Experiencing or understanding or getting insight of verb is state of experience and then knower-known or subject-object are not attached to the verb. Verb will be in a present continuous form or infinite form depending on it is absorption of information or understanding cognition or experiencing cognition or urge (to express or do) or intuition (result of perception or instinct took form or genetic knowledge expressed through hormones or like them) or sense or meanings of utterances received or to be expressed [12-14].

We knowingly or unknowingly alternate between non-dual (advaita) and dual (dvaita) awareness while functioning mentally. Wakeful and dream conscious states of mind represent and account for the phase of mind when functioning and then we also are aware of and sense or perceive self-consciousness. Once mind ceases to function, we experience peace, bliss and silence within. If these are experienced our being aware them, the phase of mind then is known as wakeful sleep. If we are unaware, but are conscious of
these, the phase of mind then is known as deep sleep. The phase of cessation of mental functions (also self-consciousness) is similar to zero in number system and vacuum in physical and biological sciences. Vacuum is inherent in matter and holds matter and is manifested when matter is missing or absent. Consciousness is awareness of mind when no mental functions are taking place. This idea is further elaborated below [2-12].

Simply put, according to Upanishads, human mental functions are the forward and backward transformations of chidabhasa or maya or pranavam - the carrier (in the sense of carrier radio wave in broadcasting and reception process) cognitive-energy pulse series, modulated by energies sensed through sense organs or the stored information as potential energies retrieved (as vasanas - object-experiences, which include meanings of utterances, first and then jagat [inner world] as feelings/thoughts/perceptions) and demodulated to give humans knowledge, experiences etc. The transformation of maya, reverse transformation of maya and cessation of transformation of maya - the dvaita and advaita conscious states respectively- taking place simultaneously, consecutively and alternately is the structure, form, function, state and essence of human consciousness, mental functions and cognitive processes [8] Most of present attempts aim at modeling machine cognition as an isolated process which is the result of sensing. But if human mental processes are observed, it becomes obvious that human perception is but an intermediary process which transfers sensing into sense (understanding/experience) and sense into expression. Human cognitive process can be stated sequentially as follows: (1) sensing: through sense organs (knowing), (2) perception (thinking, reasoning, decision making, etc.,), (3) understanding/experience, (4) purport-meaningful experience or experienced meaning. Human mental process is generally held to be a combination and quick successive transformations of four modes i.e.,

I Speaker/Teacher: (a) Purport/Awareness (Meaningful Experience or Experienced Meaning) (b) Understanding/Experience (c) Perception/Thinking (d) Utterance /Expression

II Knower/Listener/Learner: (a) Knowing (through sense organs) (b) Perception/Thinking (c) Understanding/Experience (d) Purport (Meaningful Experience/Experienced Meaning)/Awareness.

Four conscious states of mind, which are phases, cognitive and functional states of mind and seven cognitive states of mind: (Sapta Lokas) [7] (Concept Diagram III) and four modes of language acquisition and communication are available (Concept Diagrams I to VI). These ideas are further advanced as follows.

Vakyapadeeyam-Brahmajnana and sphota vada: Modern physics meaning of Brahman and maya/pranavam/sphota- the ingredients for human consciousness, mental functions and language acquisition and communication process:

Brahma Jnana:

Vakyapadeeyam text endorses all the above understanding of concept of mind and its functions and describes, discusses and proposes insight relating to human language acquisition and communication. The following sloka from Brahma Kanda of Vakyapadeeyam is the gist of what all is discussed above.

I  anaadi nidhanam brahma sabdatatvam yat aksharam

vivartate arthabhaavena prakriyaa jagato yatah
This sloka states Brahma nityatvam and vivartanopadatvam of jagat as meanings/senses (artha)/urges/thoughts/feelings (bhava)/expressions/utterances-the arthabhavana prakriyaa- from Brahma. Sphota is upadana karana – material cause of jagat which is a restatement of all that is discussed, the Advaita insight of Adi Sankara (Upanishadic Commentaries) and Vidyaranaya (Vedanta Panchadasi), in the earlier sections.

All this can be scientifically stated that, Atman or Brahman is the result of breathing process [19-20]. Srestaprapna, (most possibly O2, and the consequent rhythmic gaseous exchange taking place in the lungs) is given as the body (tanu) of Atman Vasista Ganapati Muni [19-20]. Atman is always in motion (yasya gamanam satatam tat atma – which moves incessantly is Atman) and is the result of breathing process and in modern scientific terms can be termed as a bio-oscillator/bio-maser/bio-laser issuing out pulses of mental (chit) energy [8]. A period $10^{-1}$ of a second, the time required to pronounce a short syllable like ‘a’ is put forward as the time-period of this oscillator {It is interesting here to mention that the mental rhythms detected by the experiment by German scientist Hans Berger [21] using EEG (electro-encephalogram) also have the same time-period of $10^{-1}$ sec}.

Thus this insight proposes Atman or Brahman as a biomechanical oscillator of frequency in the infrasonic ($< 10$ Hz) range [8-14].

**Sphota Vada:**

The above model of Atman/Brahman and maya/pranavam perfectly suits, reflects and represents Sphota Vada beautifully. Maya, also known as pranavam, and its transformations understood in combination with the Sabdabrahma Siddhanta throws light on language learning and communication processes. The exposition in Vakyapadeeyam, jagannaidanam sphotakhyaha niravayavaha nityaha sabdaha brahmaiveti clearly informs atmachaitanyam itself is sphota. Thus sphota is Brahman or atman or chit sakti in content. Sphota is para vak which precedes pasyanti, madhyama and vaikhari in the speaker/teacher and succeeds in listener/student/leaner and transforms itself to be these three vaks. Sphota originates in the Brahman of speaker to be upadana (material) and nimitta (instrumental) karana (cause) for both communication and acquisition of languages/disciplines/knowledge/skills and merges in the Brahman of the listener to give meaning/experience and oneness with what is said and heard/cognized.

Though para vak nomenclature is later to Bhartruhari, it correctly and aptly fits in the scheme of explanation and understanding the process of language communication and acquisition in humans. This is available in the Brahma Kanda of Vakyapadeeyam (slokas 111 to 117) itself even though the term para vak is not used. The gist of these slokas pertains to the stating of the existence of a subtle energy [termed as Jnaata (which is Atman/Brahman itself)] and its vivartanam- tirodhana purodhana yuta vartanam-reversible becoming of sphota as jagat by prakriyabheda is very clearly put forward. Also para state is consciousness in Advaita (Aham-Aham series) phase and awareness in dvaita (Aham-idam series) phase (Aham=Atman/Brahman, idam=prapancham, jagat or viswam and corresponds to state of mental functions).

According another school of thought para is opined to originate at mooladhara, pasyanti is formed in nabhi, madhya in hrudaya and vaikahri at kantha. These actually correspond to the
evolution of physical form and shape of uttered sound-the vaikhari mode of language. Para vak becomes pasyanti and is in subtle form in buddhi (bodha-awareness) and this is what cognized by the listener. This will be in electrochemical form and originates in the brain. Brain signals are transmitted through spinal cord to the mooladhara and the physical sound form starts to take shape by combining with air (pranavayu) that is being breathed and culminates as audible sound in vocal chords transduced from electrochemical form to mechanical/sound form and is expressed by the movements of the cheeks, tongue, lips etc.; all this is nomenclature for the physical evolution of uttered sound, vaikhari, whose origin is in the brain. Dwaupadana sabdeshu….. sloka also informs that sphota is the real sabda which is different from audible sounds and itself by transforming (actually transducing-changing from one form of energy into another form of energy)- becomes various sounds represented by various letters by associating with the movements of vocal chords which in turn are manifested in the movements of cheeks, tongue, lips etc.,

Sphota is thus synonymous with pravanavam and is the infrasonic form of sound energy pulses (frequency less than or equal to 10 Hz). This definition very well suits the traditional one that sphota is issued out, by veechi-taranga (air waves) nyaya or kadamba-mukula (kadamba-flower bud) nyaya. As is known the very term ‘sphuta’ means which is issued out. Further the silent nature of the sphota is both because it originates from silence (nature and physical form of Brahman-the infrasonic oscillator of frequency 10 Hz). Sphota is prakrutha dhvani (primordial sound, the pranavam) which reversibly transforms itself to make humans conscious, cognitive and communicative through language. Thus Sphota is physically infrasonic sound form and is responsible for all human mental functions both materially (upadana karana) and instrumentally (nimitta karana) [14].

Also according to Upanishads knowledge is of two kinds- (i) that acquired through the combined operation of sense organs, action organs and inner mental tools in the awareness of Atman (Maitra Jnana) and (ii) that is inherent / genetic/hormonal (Varuna Jnana) [7]. All our acquisitions of knowledge come under Maitra Jnana and the in-built senses (iccha and artha saktis), urges, volitions, body and mental abilities, capabilities, nature etc., come under Varuna Jnana. In both the kinds of acquiring and retrieving knowledge from without the body and within the body, sphota plays chief role.

Theory of language acquisition and communication:

Vivartanam is the type of change that sphota undergoes while sristi (creation of mental impressions or mental world during language acquisition and communication) takes place. When sristi is being created or is in the dristi (Conscious awareness), we are mentally functioning. When sristi is in the awareness a veil is formed on dristi and creates adhyasa. According to Advaita thought only two mental situations are available for humans in the consciousness of the Atman. The situations are nidra or sristi. Nidra corresponds to the sushupti state of consciousness or phase of mind (Concept Diagram I). During this phase of mind, all mental functions cease to be in the awareness and maya, whose transformations these mental functions are, becomes nirvishaya suddha vasanaa pravaaham. During this phase of mind maya
does not bifurcate as divyam (jnana sakti) and swaram (prana sakti) as in jagrat and swapna conscious states and both sense and actions organs remain dormant and functionless (also see Concept diagrams II to IV) [2-8]. Thus Sabdabrahma Siddhanta based on Upanishadic and Advaitic insight provides four modes of language communication and reception process; para-- mode of awareness--; pasyanti –mode of verb or sense or mood--; madhyama -mode of sentence,-- and vaikhari –mode of utterance in sound form, which can be successfully used to understand human language acquisition, communication and usage processes [8],12-18

**Concept of Bhakti and Vibhakti:**

Bhakti defined as

swa swaroopanusandhanam bhaktirityabhidhiyate-tuning the mind to its origin and original form (Upanishads) or cheto vrittirupetsyay tisthati sadaa saa bhaitirityuchyate-the state in which the mind disengages itself from all vrittis (Sivanandalahari)- antahkararana parinamas (manasika gathi)- reversible transformations of inner mental tools-manas, buddhi, ahankaram and chittam- and attains nivritti state (nirmala manasika sthiti) stays as that - is the normal or natural or ground –energy state of mind. This is the state of absence of mental functions - the two-way transformation of maya /pranavam/sphota and antahkarana- This is the state of Atman or Brahman as tatpara or tatparya or rasa.. In this state the chidabhasa or virtual chit -energy maya/pranavam/sphota – does not transform into antahkaranas (no vivartanam takes place) and no antahkarana parinama takes place. This state is also known as suddha sattava guna state, which amounts to nirguna state. Rajo guna (antahkarana mode) or Tamo guna (antahkarana parinama-cognition of objective energy-form) cease be (Concept Diagram I to V). Transformation of maya/pranavam/sphota, reverse transformation of maya/pranavam/sphota and cessation of transformation maya/pranavam/sphota-the dvaita and advaita conscious states respectively- taking place simultaneously, consecutively and alternately is the structure, form, function, state and essence of human cognitive, language acquisition and communication processes. All this is also embedded int the following slokas of Brahma Kanda of Vakyapadeeyam.

II chatvaari sruangaa trayo asya pada dwe seershe saptahastaaso anyah

Tridha baddho vrushabo rooraveeti maho devo martyaan avivesa

III chatvaari vaakparimata padaani taani viduhu braahmanaa ye maneeshinah

guha treeni nihita nengayanti tureeyam vaacho manushyaah vadanti

IV vaikhyaarya madhyamaayaascha pasyantyaascha etat adbhutam

aneka teertha bhedaayaastryyaa vaachaha param padam

V uta tvah pasya nna dadars vaacham uta tvah srunva nna srunoti enaam

uto tvasmai tanvam visasre jayena patya usatei suvaasaah

and Paanineeya Siksha -

Aatma buddhyaa sametyarthaan mano yunkte vivkshaya

Manaha kaayaagnimaahanti sa preyarayati maaruthum
Maarutastoorasi charan mandram janayati swaram

According to theory proposed in the above expressions the human language communication process is a combination and quick successive forward and reversible transformations of four modes i.e.,

I. Speaker/Teacher: Language communication:

(a) Pure Consciousness/Purport/Unoccupied Awareness (Meaningful Experience or Experienced Meaning- para)

(b) Understanding/ Experience/ Sense/ Mood/Volition/ Intuition (pasyanti)

(c) Perception/Thinking/Feeling (madhyama)

(d) Utterance /Expression (vaikhari)

II. Knower/ Listener/ Learner: Language learning/acquisition and understanding:

(a) Knowing (through sense organs)- vaikhari

(b) Perception/Thinking - madhyama

(c) Understanding/ Experience/Sense/mood/Volition/Intuition -pasyanti

(d) Pure Consciousness/Purport (Meaningful Experience/ Experienced Meaning)/Unoccupied Awareness- para.

In this theory the advaita state - Jagrat Sushupti- proposed by Vedantins corresponds to para mode of language communication process (Concept Diagram II to V). This is the tatparya (purport) or rasa (experienced meaning) state. This tatparya state is a state of awareness of experience of meanings. And in this awareness the untransformed maya is the flow of suddha vasanas. Pasyanti mode of language is the state of senses (of words/sentences) or artha sthiti or state of verb. The verb will be in a present continuous or infinite form without subject and object [5], [9], [12-14].

When an object energy-form, the tanmatra, [objective energy forms- optical-light(eye), mechanical (ear) -sound chemical (nose and tongue), mechanical, thermal(skin) (Concept diagrams I and II) – a vishaya - ] is sensed through antahkaranas, this verb state becomes a state of sentence – bhava or thought. This state is known as madhyama mode of language -the vibhakti state of sentence or thought and is the modulated sphota (undergone vivartanam) (Concept Diagrams II to VI). This modulated energy- form gets transformed into sound energy through vocal chords’ movement and is expressed /uttered. This is the vaikhari mode of language. All this happens in the speaker/teacher.

This uttered sound-energy (the vaikhari mode of language) is picked up by the ears (sense organs) of the listener/learner and becomes sentence in the madhyama mode- the modulated sphota mode in conjunction with the antahkaranas (inner mental tools). This sentence-energy form in madhyama mode is in subject-verb-object (the triad-triputi) form. This mode of language gets demodulated (reverse transformation of sphota - the vivartanam in the reverse direction) into meaning, resulting in understanding/experience in the pasyanti mode- to a verb (sense), in present continuous or infinite form, the subject and object being dissolved in the sense of uttered /expressed sound.. This, when meaningfully experienced in the awareness of para mode, is the purport or rasa or tatparya of the uttered word- Bliss,
Being, Peace or Unoccupied Awareness, the normal or natural state of mind - i.e., the state of Self, Atman or Brahman.

Thus chit-energy pulses, being issued out by Atman (Sat-Chit-Ananda) and after getting reflected in the medha as virtual or chit-energy (chidabhasa or maya or pranavam or sphota) pulses, first get modulated from this para / rasa / tatparya state by cognizing stored energies in potential (jada) form—in the form of subject-object-free verbs/senses, experiences, intuitions, understandings, urges, volitions through the antahkarna chittam to be transformed in to the mode of pasyanti; then again gets transformed into subject-verb-object state, the madhyama mode - by simultaneously cognizing the object energy-forms —vishayas, stored as potential energy (jada) forms — as idam, jagat or prapancham through the antahkarana, manas in the awareness of within — antarmukha dristi- as bhavas or thoughts. Intellectual operations such as reasoning, decision making, take place in this awareness. When the antahkarana, manas is tuned to the object energy-forms (light-eye, sound-ear, chemical-tongue, nose and heat, mechanical-skin) through jnanendriyas—sense organs—then the awareness becomes bahirmukha dristi-awareness of without. This process (in expresser/teacher and the reverse of this process, (demodulation in listener/knower/learner) happen in human-beings while expressing/speaking or listening/learning— as transformation or reverse transformation respectively—together known as vivartanam—of maya/sphota and antahkarnas in conjugation with sense organs and action organs, karmendriyas (Concept Diagrams II to VI).

The gist of all above expressions and discussions is:

**Consciousness (Being-Sat) | Awareness (Becoming-idam)**

**Speaker:** Modulation-purodhana

Brahman/Atman chidaabhaasa/maya/pranavam antahkaranani karmendreyani / jnaanendrayani

Import | experience/understanding/insight | feeling/thought/perception | actions/reactions/cognitions

---------- | Vivartanam-Reversible Becoming | ----------

Bhakti | sphota+icccha/artha sakti | vibhakti / jnana sakti | ucchaarana/kriya sakti

Para/tatpara/ Tatparya | pasyanti | madhyama | vaikhari

Purport | mood/urge/sense/verb | sentence/subject-verb-object | sentence in sound form

---------- | tirodhana - Demodulation: Listener

**Application:**

Several branches of learning take study of mental processes as one of their subject matters. Epistemology, psychology, physiological psychology, neurology, artificial intelligence and cognitive sciences contribute to the study of the mental processes in their own way. Up to now, however, little has been done to combine the approaches — let us say — of the physiological psychologists and neurologists who see cognitive process as a biochemical and biophysical energy transformation with the proponents of mind-machine modeling, who have a lot to say on pattern—recognition, memory and learning and the Upanishadic insight which has understood human consciousness and analyzed mental functions.
The insight of human consciousness and mind and its functions together with *Sabdmabrahma Siddhanta* and *sphota vada* in modern scientific terms presented in this communication can be used to develop the software to model human cognitive processes and language learning/communication processes going on within humans, and compare them with the working of the bio-chemicals and bio-materials and the energy transitions and transformations associated with such transitions.

Most of the present attempts try to model thinking as an isolated process which is the result of sensing. But if human mental processes are observed, it becomes obvious that thinking is but an intermediary process which transforms sensing into sense and sense into utterance/expression. This sequence of human mental processes can be applied and the human cognitive model obtained thus can be refined and developed to build the soft-ware to model human understanding/experience process in conjugation with existing mind-machine models [22-27]. This can also be used by the physiological psychologists to model the biochemical and biophysical energy transforms that take place during human cognitive and language learning/communication processes.

Thus, this article presents human consciousness as a physical entity as an oscillating energy-presence issuing out infrasonic energy pulses constituting *sphota* proposed by Sanskrit grammarians. This oscillator has a time period $10^{-1}$ sec in accordance with both eastern and western knowledge. It will be beneficial to use *Upanishadic* insight, clubbed with *sphotavada* as is done here, in clearing conceptual issues relating to consciousness, experience, understanding, sense, mood, meaning etc., to reach the stage of extending available mind–machine schemes to model human consciousness, mental functions including language acquisition and communication processes. Translating software obtained thus into artificial intelligent, combining existing mind-machine models will be a useful application. Further, physiological modeling of mental functions by combining the study of bio-materials such as neurons and proteins and energy transformations by and through them clubbed with *Upanishadic* awareness of mind and its functions helps to understand the physiological processes relating to psychological processes.

**Conclusions:**

*Sphota* is an infrasonic form of energy issued out in *Bhakti/tatpara/tatparya* state of *Brahman* from *Brahman*. *Jagat* is tagging of *namam* and *roopam* to *sphota* and is modulated (in speaker)/demodulated (in listener) form of *sphota*. Sphota in conjugation of *icchasakti* and *artha sakti* (both are biochemical forms of energy and are genetic/inherent/hormonal to the organism i.e., human-beings) becomes *pasyanti* as verb form in present continuous or infinite form creating moods/senses/intuitions/volitions/urges bereft of subject and object and further becomes *madyama* into a sentence form in conjunction with *jnanasakti*, with subject and object tagged and gets transduced into sound form as *vaikhari* in conjunction with *kriyasakti* and is uttered. Both *jnanasakti* (electro-chemical form of energy) and *kriyasakti* (mechanical/sound form of energy) are biophysical forms of energy and are created by the combined operation of sense organs, action organs and inner mental tools (*anthakarranas*). In the organism human-being the hardware of this process is hormones, neurons and proteins which carry out the required energy-transitions and transformations through brain, spinal cord, nervous system which includes sense and action organs.

Penrose [24], [25] opines that the brain activity responsible for conscious understanding must depend upon a *physics* that lies beyond computational simulations. He also says that consciousness
and mental functions are not merely algorithmic and says that a robot functions at the expense of intuitive qualities. In the light of this and also our observation and experience, the *physics* behind human mental functions and language acquisition and communication processes is necessary to be understood and an attempt is mad in this article for the same. *Sphota* is stated as infrasonic wave series and it is the real *sabda* and other modes of language are its forward and reverse becoming. So a physics and electronics insight provided here will be *complementary* and *supplementary* to mathematical and computational approaches in this field of research and understanding concerning theory of Sanskrit language and grammar.

Thus functional structure of mind and its transformations while acquiring and communicating language, knowledge and skills will be better understood by physics and physicochemical theory of human cognitive functions and abilities. The software for all these is available in the Upanishads, *Advaita Philosophy, Gayatri Mantra, Sabdabrahma Siddhanta* and *sphota vada*. These expressions when translated into modern scientific terms making use of concepts available in physics and communication engineering, as is done in this presentation, will clarify and resolve conceptual difficulties regarding understanding and experience and provide flow-chart and gross energy transformation model which can automatically evolve into algorithms constituting the software for mind-machine models. The expressions, discussion and conclusions given here thus point out to the distinct and different nature of natural language comprehension to natural language processing. Natural language comprehension is biochemical and biophysical where as natural language processing is more computational. Natural language comprehension process when understood will be useful in developing mind-machines which can mimic more human mental functions.
Eyes, ears, nose, tongue and skin are *sense organs.* Movements related to hands, legs, vocal chords, reproductive organ and bowels are *action organs.* **Manas, Buddhi, Chittam and Ahamkaram are antahkaranas** (inner mental toolshappening in Jagrat (wakeful) and swapna (dream) conscious states. Sushupti – State of cessation of mental activities. *Jagrat Sushupti* – Pure Consciousness Bliss Peace
ARCHITECTURE OF MIND ACCORDING TO SABDABRAHMA SIDDHANTA

SAT-CHIT-ANANDA/ PARA
ATMAN-BRAHMAN BIO-
OSCILLATOR Generator of
psychic energy pulses
Adwaita Consciousness

Source of mental
energy/mental
time-space/ Pulse
frequency 10 Hz

MAYA OR CHIDABHASA OR
PRANAVAM Virtual chit –
energy Pulses SPHOTA

MIND- Dvaita Awareness

Infrasonic
/Electrochemical Divyam

Mechanical- Kriyasakti /
Swaram

Inner mental tools

Five kinds

Prana, Apana , Vyana,
Udana, Samana

Karmendriyas

Action Organs- Movements of
-Leg, Hand, Vocal Chords,
Reproductive organ, Bowels.

MANAS

Chittam – Icchasakti/artha sakti
Cognition created
Experience/ Meaning Understanding
-vasana Recording & Recollection

Jnaanasakti Manas – Perception –
Recording & Recollection of
cognitions. Buddhi - Intellectual
functions Ahamkaram – Self-
consciousness-Prapancham-
potential; Jagat-kinetic/dynamic

Jnanendriyas – eyes, ear, nose, Tongue,
skin – Sense organs- Sense Stimuli-
light(form)/sound(word)/chemical
(smell. taste) mechanical, heat (touch)

ACTION/REACTION ACCORDING TO
SENSING, EXPERIENCE/VOLITION
/ UNDERSTANDING/SENSE/
INTUITION/INSIGHT/ MOOD
/PERCEPTION/THOUGHT OR URGES

Language acquisition and communication - is a combined operation of all these
CONCEPT DIAGRAM III: STRUCTURE AND COGNITIVE STATES OF MIND

Cognitive States of mind

Wakeful
Awareness of without
Jagrat
State of Knowing

Dream Swapna
bhuvaha State of perception madhyama
Sentence: Subject + verb + object

‘I’- thought
mahaha State of egoistic thoughts

janaha State of mood-sense – intuition Pasyanti

‘I’- sense
experience-understanding- urge

One-pointed Awareness
tapaha State of meditation-concentration
Vivartanam (purodhana/tirodhana

Reversible becoming

Deep Sleep
suvaha State of Normal, original or ground state of mind, No awareness of within/without

Wakeful sleep
satyam State of Bliss, Peace, Silence

Unoccupied awareness
Pure Consciousness
Ego-transcending, Ego-free

BHAHTKI

JAGRAT SUSHUPTI STATE OF PURE CONSCIOUSNESS

NON-DUAL ADVAITA- NO TWO PARA RASA
CONCEPT DIAGRAM IV
FLOW CHART OF HUMAN MENTAL FUNCTIONS INCLUDING LANGUAGE PROCESSING

BIO-MECHANICAL OSCILLATOR (frequency 10 Hz)

BHAKTI RASA visrantam Nidra SUSHUPTI
JAGRAT SUSHUPTI / PARA TATPARYA IMPORT
TATPARA PURPORT Sristi pralaya or viraama samayam

BHAKTI

antarmukham

tirodhaana

PASYANTI

VIRTUAL VIVARTANAM bahirmukham

MADHYAMA

purodhaana

Ichhasakti VIBHAHTI SRISTI (potential form)

CHITTAM (smaranam) CHITTA VRUTTAYAH BUDDHI VICHASHANA

Jnanaasakti (grahanam) ANTAHKARANAANII JAGRAT / BHAAVAII Dynamic/ Kinetic form

MANAH AANTARAJAGAT/SRISTI/ IDAM AHAMKARAM JIVA BHAAVAII/LAKSHANAANII

SWAPNA JNAANENDRIYAAANII VAIKHARI Kriyasakti

BAAHYA JAGAT VA STIMULI

ACTIONS AND / OR REACTIONS

ATMAN BRAHMAN PARA

MAYA / CHIDAAHAAASA / PRAKRUTI / PRANAVAM

SADDHA VAASANAAN

NIRVISHAYA ANUBHAVAH

SPHOTA
## TABLE V

**COMPARISON OF HUMAN COGNITION AND LANGUAGE ACQUISITION AND COMMUNICATION PROCESSES – YOGA, JNAANAM AND BHAKTI**

<table>
<thead>
<tr>
<th>YOGA</th>
<th>Human Cognition Process</th>
<th>JNAANAM</th>
<th>BHAKTI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowing</td>
<td>knower-knowing-known</td>
<td>Sense organs</td>
</tr>
<tr>
<td></td>
<td>Unoccupied, Awareness,</td>
<td>Demodulation/Modulation Experience/Meanings of cognitions, Understanding Memory (I-sense)</td>
<td>Cognitions</td>
</tr>
<tr>
<td></td>
<td>Bliss, Silence, Peace,</td>
<td>Self-consciousness, Thoughts/feelings around individual/ego</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meaningful Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real I State</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SPHOTA + VERB**

**VIBHAKTI (SPHOTA AS SENTENCE)**

<table>
<thead>
<tr>
<th>MAUNAM / BHAKTI / RASA</th>
<th>Human Language Acquisition and Communication Process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experienced Meaning Purport Rasa Tatpara Para Tatparya</td>
</tr>
<tr>
<td></td>
<td>Verb in infinite or present continuous form without subject and object-senses/meanings Pasyanthi KARANA</td>
</tr>
<tr>
<td></td>
<td>Verb with subject and object in respective tense Sentence Madhyama SUKHMA</td>
</tr>
<tr>
<td></td>
<td>Utterance Movement of vocal chords hearing Ear Vaikhari STHULA</td>
</tr>
</tbody>
</table>

**Pranavam/sphota + Icchhasakti/Artha sakti + Jnaasakti + Kriyasakti**

<table>
<thead>
<tr>
<th>Volition /Urge</th>
<th>knowing</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intuition/insight/understanding</td>
<td>perception</td>
<td>Action</td>
</tr>
<tr>
<td>Mood/Sense/Experience/meaning</td>
<td>logic/reasoning</td>
<td>Reaction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biochemical/Genetic/Inherent/HORMONAL</th>
<th>Biophysical</th>
</tr>
</thead>
</table>
Experiences/Perceptions of mind are the reverse process of generation of bhavah / artha (thought/feeling/sense/meaning/understanding/insight)

### TABLE VI

**MODES OF LANGUAGE ACQUISITION AND COMMUNICATION**

<table>
<thead>
<tr>
<th>ADVAITA PHASE</th>
<th>DVAITA PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHAKTI</td>
<td>AWARENESS</td>
</tr>
<tr>
<td>CONSCIOUSNESS</td>
<td>VIBHAKTI</td>
</tr>
</tbody>
</table>

**Transformations of Pranavam/sphota**

<table>
<thead>
<tr>
<th>Pasyanthi</th>
<th>Madhyama</th>
<th>Vaikhari</th>
</tr>
</thead>
<tbody>
<tr>
<td>Para</td>
<td>Sphota</td>
<td>Language Teaching/Communication Modulation</td>
</tr>
<tr>
<td>Import</td>
<td>Volition</td>
<td>Purodhana</td>
</tr>
<tr>
<td>Tatparya</td>
<td>Mood</td>
<td>Vocal chords</td>
</tr>
<tr>
<td>Purport</td>
<td>Sense</td>
<td>Utterance</td>
</tr>
<tr>
<td>Rasa</td>
<td>Intuition</td>
<td>Ear senses</td>
</tr>
<tr>
<td>Unfounded</td>
<td>Urge</td>
<td>Utterance</td>
</tr>
<tr>
<td></td>
<td>Sense</td>
<td>Eye and hand-writing</td>
</tr>
<tr>
<td></td>
<td>Meaning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sentence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sense</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meaning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sentence</td>
<td></td>
</tr>
</tbody>
</table>

**Modulation**

**Purodhana**

**Tirodhana** Language acquisition/understanding

**Demodulation**

**Note:**  *Vivartanam = purodhana - tirodhana yuta vartanam or parivartanam* is Reversible Becoming of sphota, the infrasonic mental energy pulse series-facilitating human language acquisition and communication.

Language acquisition/communication is a combined operation of ear/vocal chords (pronunciation), Eye/hand (to see and write shapes of alphabet) in conjugation with cognitive states of mind and modes of language acquisition and communication.
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