

## Is it possible to develop a mathematical model of a Self-Conscious Unit?<sup>1</sup>

### Abstract

Modern physics grew rapidly in the recent years on the basis of Abstraction, Generalization and Idealization.<sup>2</sup> An important reason for such rapid development is our ability to choose a mathematical representation of our experience of the physical world. The earliest example is the geometrical representation of the astronomical observations followed by a mathematical model. This historical aspect serves as an example (with the benefit of hind-sight) of successful effort in abstraction, generalization and idealization of our experience.

However, a fundamental difference exists between a model of the external world observed by means of an instrument, and an attempt to model a self-conscious unit. The former has the advantage of calibrated instruments for observation, whereas the latter does not have, by definition, such instruments. This limitation arises because of a fundamental difference between an objective world and a subjective world.

There exists some hope of overcoming the fundamental difference by resorting to the Ergodic Hypothesis introduced in physical sciences at a time when statistical physical theory was developed on the basis of dynamics applicable to an individual particle.

“It ( Ergodic Hypothesis) is the statement that the time average value of an observable—which of course is determined by the dynamics—is equivalent to an ensemble average, that is, an average at one time over a large number of systems all of which have identical thermodynamic properties but are not identical on the molecular level. .... . The general consensus is that the hypothesis, still mathematically unproven, is probably true yet irrelevant for physics.”<sup>3</sup>

This hypothesis can be interpreted in an alternative way. It corresponds to the assumption that in a ‘stationary system’ of large number of individuals, the ‘average’ model of an individual is the ‘average at one time’ of a large number of individuals.

This in itself is not sufficient for modeling a self-conscious unit. We define a self-conscious unit by three necessary qualities. In the language of communication theory, a self-conscious unit must be a transponder which should be sensitive, selective and stable for a large number of independent variables in any selected range. It should also be capable of distinguishing between its interior and exterior. It is a transcendental unit.

This article attempts to argue that such a nonlinear system can be represented by transcendental numbers familiar to mathematicians and physicists as well. It needs, however, a close scrutiny and willingness to ‘read’ afresh a meaning into mathematics.

### Introduction.

The combination of the words – ‘Self’ and ‘Conscious’ - implies that one understood the meaning of the words Self and Conscious separately, and hence one can understand the combination Self-Conscious. The meaning that is given to any word is closely related to

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<sup>1</sup> ESWARA’s 2 Day National Seminar: Ancient Indian Sciences and Their Relevance to Modern Society. October 20,21, 2011, NGRI, Hyderabad

<sup>2</sup> *The Ideas of Physics*, Earnst H. Hutten. Contemporary Science Paperbacks, # 6.

<sup>3</sup> *The Ergodic Hypothesis*. Adrian Patrascioiu. Los Alamos Science Special.Issue. 1987.pp.263-278

the experience of a living being, which reveals the circularity in the underlying logical basis of language. Assuming that such inherent feature is unavoidable, the question is raised and accepted as the title of this article. This article is based on our present knowledge of scriptures whose validity is accepted provisionally but not dogmatically. It is subjected to further scrutiny. We accept the validity of mathematical truths based on clearly stated axioms and rules of logical deduction and attempt to use them for our purpose.

The rapid advancement of science in the recent years is a cumulative result of idealized methods adopted by Newton. An essential feature in the Newtonian approach is to reduce a complicated problem to a relatively simpler problem. Newton reduced the problem of the movement of the planets in the solar system to that of a binary problem, that is, the problem of interaction of the Sun and one planet only. He ignored the presence of all other planets. In the language of mathematics, he reduced the many-body interaction to that of interaction of two bodies only. It was a fortunate event that he succeeded. It is not generally realized that such an approach is not workable in all branches of our experience

The advancement of physical sciences reached such high pinnacle that notions like conscious machines are topics of serious discussion by philosophers.<sup>4</sup> As stated in the abstract, it is not clear whether one can take any clue about nature of a conscious entity by following methods successful in the material world.

The central principle of all knowledge is consciousness.<sup>5</sup> The valid knowledge (*pramaa*) is viewed in Advaita Vedanta in two main aspects: as Pure Consciousness (*suddha chaitanya*) and as modal consciousness (*vrutti chaitanya*). Pure Consciousness is beyond the subject-object relation.....Modal consciousness finds expression through the subject-object relation. It is relational, finite and varied in kind and marked by degrees of manifestation. It is the modal consciousness that we call as Self-Conscious Unit.

We start our discussion with a definition of Self-Conscious Unit (S.C.U) by the two qualities imputed to it. First: It must be a like a transponder which is Stable, Selective

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<sup>4</sup> *Minds and Machines: A Radical Dualist Perspective*: John Beloff. Journal of Consciousness Studies. **1**. #1. Summer 1994.pp.32-37.

<sup>5</sup> *Methods Of Knowledge*. Smami Satprakashananda. Advaita Ashrama. 1974. p. 62  
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and Sensitive to an unlimited range of inputs and outputs.<sup>6</sup> Second: It must be aware of Its interior and Its exterior.

The nature of Consciousness is discussed extensively in Vedanta. “It was Acharya Sankara in India who formulated the argument for an Ontological Being in his statement that no one can deny one’s own self or one’s own existence, because unconsciousness existence cannot be conceived. In Sankara’s words, this point is expressed as *Satta eva cha bodho, bodho eva cha satta* - existence is consciousness and consciousness is existence. From the certitude of one’s own existence of one’s own self, the certitude of the existence of anything else also follows, ...”<sup>7</sup>

With these preliminaries, a Self-Conscious unit is represented by the number ‘1’. The ‘awareness’ of Its interior is represented by  $1 - 1/n$ , where n is a large number. The awareness of Its exterior is represented  $1 + 1/n$ . There exists for S.C.U. a finite ‘gap’ between the interior and the exterior, however thin it might be, The motivation underlying this attempt is discussed from the dual points of view: Metaphysical and Mathematical.

### *Drug-drusya viveka*

The word ‘awareness’ needs an explanation in the context of a S.C.U. Awareness is power of vision. It is also understood as knowledge of an object.<sup>8</sup> This topic is studied in a small book entitled *Drug-drusya viveka*.<sup>9</sup> The dictionary meaning of *Drukam* is ‘a hole or an opening’. The word *drusyam* means ‘the seen’. The phrase *Drug-drusya viveka* can be translated as: The Discrimination between the Seen and the Seer’. The first verse in this book is:

*Rupam drusyam lochanam druk taddrusyam druktu manasam;  
Drusyaa dhivruttayassaakshee drugeva na tu drusyate.*

which means: “The form is perceived; and the eye is its perceiver. It (eye) is perceived, and the perceiver is the mind. The mind, with its modifications, is perceived, and the

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<sup>6</sup> A transponder is a device in communication engineering that responds to specific signal from an interrogator.

<sup>7</sup> *Discourses/Articles*. Swamy Krishnananda. Ontological argument in philosophy. From the Internet.

<sup>8</sup> *Methods Of Knowledge*. Smami Satprakashananda. Advaita Ashrama. 1974. p. 60 and p. 90

<sup>9</sup> *Drug-drusya viveka*. Commentary by Swami Nikhilananda, Sei Ramakrishna ashram, Mysore  
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Witness (the Self) is verily the perceiver. But, It (the witness) is not perceived, (by any other).”

We notice in this verse four different notions: 1. Self; 2. Mind; 3 Eye; and 4. Form. Therefore, the awareness of any Form involves at least four individual components. The logical structure underlying the awareness is that of ‘product’ of all the four components. It is not merely ‘addition’ of the four components. In the context of S.C.U, the Self and the Mind are internal; the Eye is the interface and the Form is external. This separation is schematically illustrated below:

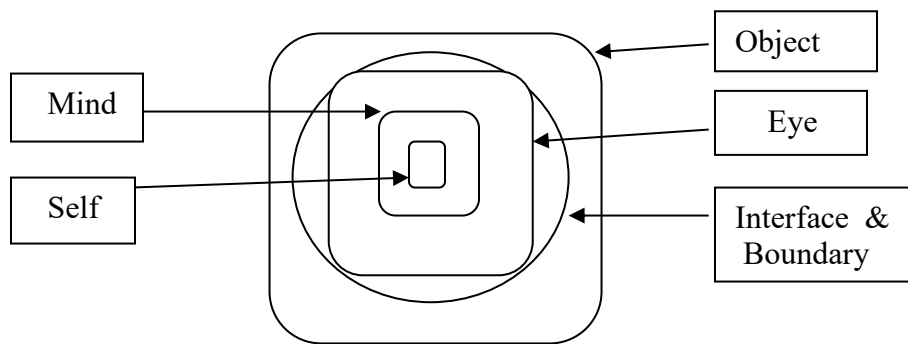


Fig. 1 *Druk-Drusya Viveka* (Schematic)  
The circular form illustrates the boundary between Interior [Self and Mind and Interface (Eye)] & Exterior (Object).

*Fig. 1 is a schematic representation of ‘Discrimination’ between the Seer and the Seen (Druk-Drusya Viveka).* It highlights the generic components. For example, the representation of Self, Mind and Eye as rectangles, is intended to display three different domains, among which the Self is primary and the rest are secondary. Further, the mind does not imply only a single constituent, but one of several other constituents playing a similar role. The Eye represents only one of several instruments collecting information. The circular form represents a transition from the interior to the exterior of S.C.F. The object is the Seen, and is in the exterior domain. As stated before, the interior of S.C.F is represented by  $1 - 1/n$ , where the number ‘n’ represents the number of instruments of knowledge.

### Orthogonality between the Seer and the Seen.

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An important difference exists between the Seer and the Seen from the stand point mathematical representation of their interaction. The Seer and the Seen are analogous to a line and an area which is perpendicular to that line, somewhat like an umbrella. Since S.C.U has to be sensitive to several objects, it has to be represented as a multidimensional unit, such as  $1^n = 1 \times 1 \times 1 \times 1 \times \dots$  up to n- times.

The interior of the S.C.U which is sensitive to n-inputs is represented by  $(1 - 1/n)^n$ , where  $n \geq 1$ . The value  $n=1$  corresponds to only one ‘object’ to be seen. The ‘interior’ has no external ‘object’ to be seen, by definition. Hence S.C.U for this case is represented by ‘0’. The number ‘0’ represents ‘absence’ of an object to be seen. This reminds us the truth emphasized by the Upanishads. e.g. *Adrushto Drashta* (Bruhadaranyaka Up. III. vii. 23)- “He is not seen. He is witness”.

The Exterior is represented by  $(1+1/n)^n$  for all  $n \geq 1$ . When  $n=1$ , the exterior of S.C.U is represented by ‘2’.

It would be of interest to note here that it was customary to define a mathematical function  $\exp(z)$  as  $\lim_{n \rightarrow \infty} \{1 + (z/n)\}^n$ . However, this practice was not followed later due to some disadvantages in limit definition.<sup>10</sup> But, our discussion is not affected by these historical events.

We are mainly interested in the case when  $n \rightarrow \infty$ . It would be instructive to examine the sequence of numbers  $A_n$  and  $B_n$  defined as:

$$A_n = (1 + 1/n)^n; \text{ and } B_n = (1 - 1/n)^n, n = 2, 3, 4, \dots$$

and shown in a tabular form. This Table shows the variation of only a few values in the range  $n= 1$  to 100 million.

Table of  $A_n$  and  $B_n$

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<sup>10</sup> See *A Course of Modern Analysis* E.T.Whittaker & G.N.Watson. Cambridge. (1962) .Appendix A.2. p581  
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N	$A_n = (1 + 1/n)^n$	$B_n = (1 - 1/n)^n$	Dimensions (Geometrical Interpretation on 'n')
1	2	0	One (Line)
2	2.25	0.25	Two (Square)
3	2.37	0.296	Three (Cube)
4	2.44	0.3164	Four
5	2.488	0.3277	Five
100	2.7048	0.3660	One Hundred
1000	2.7170	0.3677	Thousand
100.000	2.718268	0.3678776	Hundred Thousand
10,000.000	2.71828181	0.36787944	Ten Million
100,000,000	2.7182818148	.36787944099	Hundred Million

Note the product of last terms,  $2.7182818148 \times 0.36787944099 = 0.9999999945$ ; it is nearly

1. We paraphrase this result as:

The 'external and internal' volumes of infinite dimensional unit cube are inverses of each other! We will see later why this result is not surprising.

We noticed earlier that Self Conscious Unit is expected to be infinite dimensional and its interior and exterior are 'separated' by a 'gap'. This 'gap' increases with increasing dimensions but it is finite even when n tends to infinitely large values. The minimum of gap is 2 and the maximum is about 2.35. Such a discontinuity at interface is a significant feature, which will be examined later.

### Well known Mathematical Results

The exponential function,  $\exp(z)$ , is defined as a sum of an infinite number of terms:

$$\exp(z) = 1 + z/1! + z^2/2! + z^3/3! + z^4/4! + z^5/5! + \dots$$

where, z is real, imaginary or complex variable.

Case 1: If z is real number equal to 1, then one can see (using any pocket calculator) that

$$\exp(1) = 2.7182818284590452353602874713527\dots$$

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If we compare this number with the last entry in the above Table, we see that

$$\exp(1) = A_n \text{ as } n \rightarrow \infty.$$

The individual values of  $A_n$  and  $B_n$  steadily increase as  $n$  increases from 1,2,3, onwards.

As  $n \rightarrow \infty$ , the product

$$A_n \times B_n \rightarrow 1 \text{ as } n \rightarrow \infty.$$

Case 2. If  $z$  is imaginary number,  $z = i\theta$ ,  $\exp(z)$  is particularly interesting in the understanding of S.C.U.

It is known that  $\exp(i\theta) = \cos \theta + i \sin \theta$ , and  $\exp(-i\theta) = \cos \theta - i \sin \theta$ . The modulus,  $|\exp(\pm i\theta)| = 1$ . The function  $\exp(i\theta)$  represents a circle of unit radius for  $0 \leq \theta \leq 2\pi$ . Further,  $\{\exp(i\theta)\} \times \{\exp(-i\theta)\} = \exp(0) = 1$

### A Mathematical Model for Memory

Now, we can see the significance of the difference between the interior and the exterior of S.C.U. The function  $\exp(i\theta)$ , in the range of  $\theta$ ,  $0 \leq \theta \leq 2\pi$ , is applicable to the exterior of the unit circle. In the interior the function changed to  $\exp(-i\theta)$ , and the range of  $\theta$  is  $0 \geq -\theta \geq -2\pi$ .

If we identify  $\theta$  with time variable, the flow of time is reversed in the exterior and interior of S.C.U. If the exterior time moves from the future to the present and becomes the past, the interior time moves from the past to the present and becomes the future. The 'present' is a node where the past and the future merge. Such merging results in the faculty called Memory of the Past and anticipation of the Future. There is an yesterday, today and a tomorrow for S.C.U. (See Fig 2)

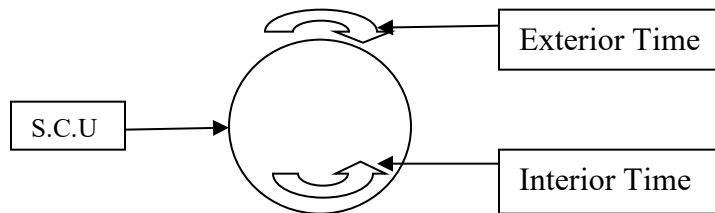


Fig 2.' Difference' in Flow of Time of S.C.U.

### Variability in Consciousness

If we consider a S.C.U with a life span of 100 years, it is mathematically a transient function. The developments in mathematical physics during the past two centuries gave us vast Model of Self Conscious Unit

understanding of such transients. The theory of Fourier transforms tells us that a transient of 100 years duration is a superposition of a large number of wave forms moving in opposite directions in time. Their periodicity may vary from a very large value to a very small value compared to 100 years. For example we can consider a duration of one day which is small compared to the life span. There would be nearly 36500 days in the life span. We can consider S.C.U to be a stationary system during one day. Since the exterior of S.C.U is not a constant system but is subjected to diurnal variations, an individual S.C.U resonates to these variations. They manifest as diurnal variations in the levels of consciousness.

There are several other features of a S.C.U that are not amenable to direct mathematical modeling. For example, the intellectual faculties manifesting at different phases of the development of the S.C.U and their decay as time progresses pose formidable problems. These are no less important than understating the nature of consciousness itself. In spite of these limitations, this article attempted to examine whether it is possible at all to model a S.C.U. As a preliminary attempt, the properties of transcendental functions were seen to contain some features that can provide a basic preliminary model for a S.C.U.

It is necessary to quote in this context, that some attempts have already been made to express metaphysical ideas through mathematical language. Jagadguru Shri Kalyanananda Bharati wrote a small text known *Purna Mimamsa Darshanam*, which is in the form of Sanskrit Aphorisms.<sup>11</sup> Among them, there is one which says that Vruttam Iswarah. It means – Circle is Godhead. He gave also arguments why a circle can represent Godhead. We do not propose to go into further details here, but reference can be made to other books for further information.<sup>12a,b</sup>

## Conclusions

It is not possible to study the nature of a S.C.U by isolating one portion from other portions. Hence, some scientists began the study of such systems as a separate class of problems

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<sup>11</sup> *Purna Mimamsa Darshanam*. Jagadguru Shri Kalyanananda Bharati.. Sri Sringeri Sri Virupaksha Sri Peetham, Sri Sadanam. Arundalpet, Guntur

<sup>12</sup> (a) *Two Facets of Geometry*, Ed, K.V. Krishna Murthy. ISERVE. 279 Rd # 8, Alakapuri Hyderabad 500035;

(b) *Paratattvagaitadarsanam*, G.S.Murty.Publ. Motilal Banarsidass. Delhi

independent of Newtonian methods. The dynamics of such systems is called Topological Geometrodynamics (T.G.D).<sup>13</sup> Topology is a specialized branch of mathematics dealing with shape of objects. It enlarges the scope of Euclidian geometry to a wider class of problems. Einstein introduced relativistic dynamics which demands that no material can move at a speed greater than that of light. Newtonian dynamics is a special case valid when the speed of motion of material is very much less than that of light. Our intuitive faculties are accustomed to the geometry of three dimensions of space and one dimensional (linear) time and movement at relatively low speeds.

The introduction of functions of complex variable has drastically changed our notions of space. An interesting, but not commonly known, notion is that of a singly connected space as well as multiply connected spaces. These mathematical words can be explained by a very simple illustration. For example, the surface of sea that has no islands is singly connected surface, but if there exists one island in the sea, the surface is called doubly connected space. The interior of a solid body is singly connected but a hollow bamboo is doubly connected. One would be surprised to be told that a human body is a doubly connected space, because the external space and the alimentary canal are contiguous.

As stated in the Introduction, ‘Consciousness is One’s own Self’. Pure Consciousness is beyond the subject-object relation. One is left with a fundamental doubt whether any model can ever be comprehended for Consciousness. But a Modal consciousness finds expression through the subject-object relation. It is the modal of consciousness that we call as a Self-Conscious Unit.

This paper is an attempt to point out some of the necessary qualities of S.C.U. can be modeled on the basis of transcendental numbers. It is hoped that this effort would be pursued for deeper understanding of this interesting problem of Consciousness. *Jijnasa*, desire to know, is a divine quality. Every individual human being is essentially a divine entity though of a finite duration. One of the most respected texts, *Brahma Sutras*, starts with the statement: *Athato Brahma Jijnasa*. It means; ‘Thereafter, hence a deliberation on *Brahman*’.<sup>14</sup>

Gurajada Suryanarayana Murty.  
Retd. Scientific Officer,

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<sup>13</sup> M.Pitk anen. Email” < [matpitka@luukthiku.com](mailto:matpitka@luukthiku.com); [http://tgd.wippiespace.com/public\\_html/](http://tgd.wippiespace.com/public_html/)

<sup>14</sup> *Brahma Sutra Bhashya*. of Sri Shankaracharya. Translation by Swami Gambhirananda, Advaita Ashrama.

Bhabha Atomic Research Center, Mumbai.  
[gurajadamurty@hotmail.com](mailto:gurajadamurty@hotmail.com)

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