

# Quid Scio? On Cognition & Knowledge

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## Abstract

This paper argues for and attempts to establish three major hypotheses: first, that some of the ideas behind today's knowledge bases in use in intelligent agents are misleading and this is because most studies tend to overlook the critical differences between the concepts of information and of knowledge, of perception and of truth; second, that knowledge acquisition (or knowledge production, as we term it) refers to the assimilation and association of disparate information according to prior knowledge and third, that all knowledge requires a context of discourse and that discourse is ultimately the source of all knowledge. In addition to arguing for these hypotheses, we also propose and make use of a rudimentary model of cognition alongside our arguments to demonstrate their validity. The afore-mentioned model is based strongly on the theories of cognition and of mind in the Sāmkhya-Yoga and Nyāya-Vaisheshika traditions of Hindu philosophy as are the hypotheses ultimately grounded in. In the course of our arguments for our third thesis, we shall conclude with definitions of thought (as being self-discourse) and sentience (as being the ability of an agent to engage in discourse with other similar agents) – terms known for being confusing and controversial to define – in terms of our idea of discourse. In general conclusion, it emerges from this '*discursive theory of knowledge*' that realistic models of human memory and of knowledge representation can only be designed if and when the elusive line of distinction between information and knowledge is drawn correctly and that the role of discourse in cognition is more significant than what is held in current lines of inquiry.

## I. Introduction

"*Quid Scio?*" – Latin for "What do I know?" – reflects one of the most fundamental questions in the cognitive sciences. What does one know? And how does one know that which one knows? In this line of inquiry, the study of cognition bears strong ties with the domains of epistemology and ontology. Cognitive science is the science of the mind – the science of perceiving and knowing – where the human mind is viewed as a complex system, which receives, stores, retrieves, transforms and transmits information (Stillings et. al., 1995, pp. 1). In this objective of understanding the mind and its cognitive

processes and modelling them, one first needs, in our opinion, to know first what one is expected to cognize – the nature of the objects of cognition, that is. The problem of knowledge and its representation is one central to cognitive science and artificial intelligence – the analysis of the concept of knowledge and the nature of the justification of belief (Stillings et. al., 1995, pp. 368). Knowledge-based agents – that have been more or less the general trend up till now – consist primarily of the representation of knowledge and the reasoning processes that bring knowledge to life (Russell & Norvig, 2003, pp. 222). In other words, knowledge representation schemes have two parts – a knowledge base and an interpreter that manipulates it (Stillings et. al., 1995). But it emerges from our comparative analysis of the underlying philosophical theories that strongly coupling the two modules of knowledge representation and reasoning lead to certain problems in cognitive modelling. Logic – the study of the principles of valid inference and correct reasoning and of arguments, valid forms and fallacies – can be shown to be often an ineffective form of knowledge representation (Stanford Encyclopaedia of Philosophy). With the integral role of first-order logic in the domains of computer science and artificial intelligence to analyse and represent *truth*, with the Platonic conception of knowledge as '*justified true belief*' and with the Platonic and Aristotelian foundations at the heart of all assumptions upon which knowledge-based systems have been built, the study of logic has overshadowed certain critical issues of epistemology in many areas of knowledge representation. The overt use of logic has resulted in the focus of knowledge-based systems shifting to concepts of truth, of validity, etc. But it is essential to realize that when we are talking of cognition, we should not be concerned with whether what we cognize is valid or invalid or true or false. Russell & Norvig (2003) identify this problem correctly and avoid the issue altogether by the use of the term "*logical agents*" to describe such systems. But it must be realized that one of the fundamental differences between the conception of knowledge in artificial intelligence and in cognitive science is that the former, as we said before, concerns itself with truth, validity and justification, borrowing heavily from classical philosophy, while the latter ought to be more concerned with just knowledge and not its explicit validation. In other words, the study of cognition should distinguish between knowing and validating what is known because validation would require meta-knowledge whose existence we find no reason to presuppose. In our approach

we have attempted to deal with this problem not by arguing against the issue within the tradition but by stepping outside the framework and attacking the problem from a different perspective, namely, those of the Sāmkhya-Yoga and Nyāya-Vaisheshikā.

In Hindu philosophy, the issue of epistemology and logic is dealt jointly by the Vaisheshikā and Nyāya traditions which had distinct origins but were later merged as one single school referred to as the Nyāya-Vaisheshikā school. In the Nyāya-Vaisheshikā traditions, a distinction is made between the different kinds of knowledge (*gyāna*), for instance, cognized knowledge and validated knowledge (*pramā*, i.e., knowledge that is validated by *pramāna* or reasoning). The Sāmkhya and Yoga traditions, on the other hand, deal predominantly with psychological evolution with the former drawing a parallel with cosmic evolution. Although they are closely related and their names are hyphenated together, they are not technically merged in the same way as the previous two traditions are. They merely bear a strong relationship where the theories of the latter tradition hold under the overarching philosophical framework of the former. (Radhakrishnan, 2008, orig. 1923) These theories are examined in more detail in Sections III and IV.

We make use of certain epistemological concepts from these traditions and construct a generic model of cognition and a theory of knowledge which we refer to respectively as the discursive model of cognition and the discursive theory of knowledge. This paper is a shorter version of an extended work of this model currently in progress (See Bhattacharyya, 2012). The hypotheses that we shall be arguing for in this paper in support of our model are listed below. It is to be noted that in our arguments some of the theses pre-suppose the validity of the others. In other words, these are cohesively coupled in nature. Also, the exact definitions of data, information, knowledge and discourse are explained in detail later on so as to avoid ambiguity and inconsistency.

**Thesis 1:** All knowledge requires a ‘knowing’ subject whereas data and information do not.

**Thesis 2:** All knowledge is interrelated and associated. Information may be disparate and disconnected but knowledge is the assimilation and association of information according to the agent’s prior knowledge.

**Thesis 3 (a):** All knowledge production requires a context of discourse. In other words, discourse is ultimately the source of all knowledge.

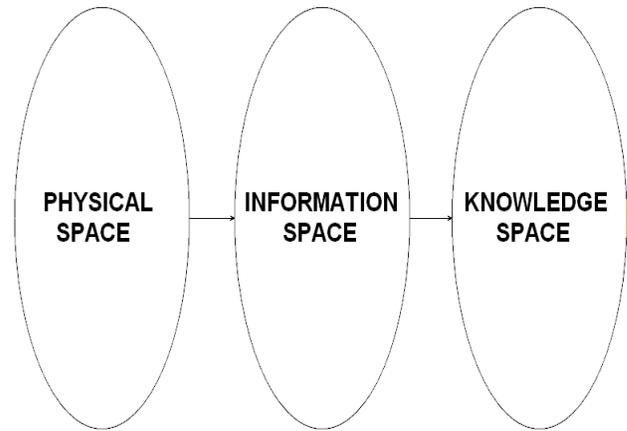
**Thesis 3 (b):** Thought is an agent’s discourse with itself – self-discourse, that is.

**Thesis 3 (c):** Sentience is the ability of an agent to engage in discourse with other similar agents.

In Section II, we discuss an ontological thought experiment by considering the existence of three different spaces (the Physical space, the Information space and the Knowledge space). In Sections III and IV, the Sāmkhya and Nyāya-Vaisheshikā traditions are explained in more detail. It must be noted that since a full explanation of these traditions is well beyond the scope of this paper, we

elucidate only the relevant portions – that is, only those which our model of cognition is based upon. Yoga therefore is not discussed at all because despite this model being based on it, the hypotheses in this paper do not require its exposition for their proof. Section V demonstrates our generic model and explains the various faculties and processes involved in the process of cognition and knowledge production drawing parallels from the original theories and tracking our derivations and deviations. Section VI explains in detail how objects of perception are cognized and how knowledge is produced, the role and significance of discourse in our model and explain why we ascribe to it so much importance so as to name our model after it. In Section VIII, we argue for Theses 3 (b) and 3 (c) and attempt to define *thought* and *sentience* in terms of our conception of discourse. Finally in conclusion, we explore open-ended questions and problems in our model and discuss how they can be resolved.

## II. The Three Spaces



There are, we hypothesize, three spaces – the Physical space, the Information space and the Knowledge space. The Physical space is the world of physical objects governed by the laws of Physics – the world of atoms, compounds, sound, light, heat, etc. The Information space is the world of representation and the residence of discourse. And subtly intertwined though distinct in essence from both of these is the Knowledge space – the world of all that we know. (See Figure 1)

Entities in the Information space represent an object in the Physical space. In other words, there exists a mapping between the Physical space and the Information space. But there are physical objects we have not perceived and not having perceived them we have never represented them; so they do not occur in the Information space. And there exists composite and complex information that we have perceived and assimilated which does not exist in the natural physical world. For instance – the symbols on this

document (the letters, the words, etc) are all physical entities (either light from a screen or ink on paper) but that they convey information to you that is not inherent in them in anyway implies that all entities in the Information space do not necessarily have an equivalent in the Physical space. What occurs in the Information space is laid bare before us – the knowing subjects - to know. When we perceive an object of the Physical space – directly or indirectly – a mapping function is first invoked. In direct perception, this is done by the mind which collects all sensory information and assimilates them into a coherent representation. In indirect perception, this may be through linguistic statements *referring* to physical objects. That which is represented is not the same as that which is known. That which is known cannot be represented. Therefore, we see from this thought experiment that firstly, it is impossible to represent all that we know because any attempt to describe an entity in the Knowledge space would be to project it onto the Information space; and secondly, entities in the Physical space are ultimately unknowable in their essential form because all attempts at perception would require at first a projection onto the Information and Knowledge spaces. This means that I could very well conjecture that the apple I am aware in front of me is not the physical apple that is present in front of me which in reality is perhaps unknowable. The image of the apple in my eyes creates a representation in the form of neurotransmitter signals of which I then come to ‘know’ of. And that which I know, I would have to first transform into representation by means of language or diagrams or any vehicle of discourse and then convey it by writing it down or saying it, that is, projecting it onto the Physical space. Therefore entities in the Information space are merely bearers of meaning and referrers of entities in the Physical space.

We compare this loosely with the concepts of data, information and knowledge – three distinct terms often confused and widely misunderstood. From data comes information. From information comes knowledge. The transformation of data to information requires syntax and the transformation of information to knowledge requires semantics and pragmatics. In this data-information-knowledge continuum, data is the absolute end and knowledge is the relative end with information serving as a necessary medium in between. What does absolute and relative signify here? From a certain data based on certain syntax, all agents can derive the same information. But from the same information, all agents may not necessarily derive the same knowledge. To use philosophical terms, knowledge, as may be etymologically obvious, requires a knowing subject. It is possible to replicate syntax but it is not possible – indeed an invalid idea of a *reductio ad absurdum* nature – to replicate semantics, pragmatics and/or discourse. Let us demonstrate with an example – I give you a set of data {1, 2, 1, 1, 2, 1, 2, -1, 1, -1, 1, -4, -1, -4, -1, -1, -2, -1, -2, 1, -1, 1, -1, 2}. For purposes of convenience, this is in decimal format – it could also have been in binary, it does not matter. Now you may be

wondering what this set of data means. Which brings me to my second argument: *data does not carry meaning*. Of course, you can find meaning in this data – you may imagine this as a mathematical progression. But you have no way of knowing what I meant. Which brings me to my third argument: there are two meanings – *intended meaning* and *perceived meaning*. In other words, meaning presupposes the existence of two agents – one which creates the data and one which perceives the data. Therefore it must be realized that in this world of communication and information transmission, data by itself is meaningless unless it is transformed at some stage to information and knowledge. Now, if I tell you what these mean – if I give you the rules governing its correct perception, that is – I can expect reasonably that you will obtain what I intended to convey. For example, say, I tell you that these are the additive components of a number. You add them up and get -4. So that was the message apparently. But notice that if I asked your parrot to perform the same feat (assuming it can do math or even a calculator instead of the poor parrot), I’m confident it’d get -4 too. So now it is obvious what I meant when I said that data is the absolute end of the data-information-knowledge continuum. Now if I tell you that the decimal numbers are to be grouped into groups of two and are to be interpreted as points on a two-dimensional Cartesian plane, I’m guessing you’d like to have a look at the data again. Now what do you see? Now you see a set of points. In all probability, you’ve already plotted it in your mind. So I hardly need to mention that it’s a polygon. So what do you see? You see a cruciform polygon. So that is the message. Therefore not how by different syntax and by different ways of the examination of the data, we obtain different information. But I’d like to point out that it’s still information – not knowledge. So how does this become knowledge? It might be amusing to note that it has already made the transformation inside *your* mind; you just aren’t aware of it yet – the process is so fast and involuntary. Every representation (symbolic in this context) has two meanings – a *denotation* and a *connotation*. The denotation of the cruciform polygon is, for all intents and purpose, a cross-like figure – nothing else. The connotation of this polygon, on the other hand, is not fixed. For those well-versed in history, it can mean the cross as a form of physical torture; it can refer to the Holy Cross and, by extension, the sufferings of Christ on the cross. For those who aren’t, it can mean other things – which we are not in a position to control. This connotation is the aspect which controls the storage and classification of a perceived entity. (After all, if a cross symbolized ‘victory’ in a given culture, then the agent would have reacted differently to the message.) And it becomes evident that one cannot transform information into knowledge without one’s prior knowledge. In other words, knowing something new requires the knowledge (and subsequent recall) of previously acquired knowledge. As data-to-information transformation requires syntactical rules, information-to-knowledge requires prior knowledge. Now it may be asked

why one would bother with such associated meanings. The problem is in our too-simple example because a cruciform polygon does not constitute a semantically valid message. An English sentence, say, “I don’t know!” is a slightly better example. The data is a string of letters {I, d, o, n, ‘, t, k, n, o, w, !}. The information is constructed by the rules of English grammar and we get a syntactically valid *sentence*. But do we get its meaning? No we don’t. We don’t know what the speaker is talking about. *Unless* we are told what the context is – prior knowledge, that is.

### III. The Sāmkhya-Yoga tradition

The Sāmkhya tradition is one of the oldest systems of Indian philosophy. The word ‘*sāmkhya*’ derived from the Sanskrit word ‘*samkhyā*’ refers to right knowledge as well as number. As Radhakrishnan (2008, orig. 1923) remarks, this system represents ‘a notable departure in thought from what may be called the formalistic habit of mind’. It rejects the rigidity of the Nyāya-Vaisheshikā categories as inadequate instruments for describing the complex and fluid universe. Instead it views the world as a creative evolution not as an act of a supernatural being. At the heart of this tradition is the theory that the effect pre-exists in the cause. From a series of deductive arguments following this predicament (which we do not describe for the sake of brevity), the Sāmkhya arrives at a duality of two unrelated entities, Purusha and Prakṛti – the former being the witnessing consciousness or the subjective knower and the latter being used to describe the ultimate unmanifest basis of the empirical universe. As an influence of the Purusha, the vast universe unfolds as a cosmic and psychological evolution of Prakṛti. The first evolute that emerges is called *mahat* or *buddhi* (the intellect or the discriminating awareness). Second to arise is *ahamkara* (ego-sense), or the principle of individuation. Other evolutes include the *manas* (the lower mind), the *jyānendriyas* (five organs of cognition) and the *karmendriyas* (five organs of conation). Also produced are the *bhūtādi* (five subtle elements), from which emerges the five gross elements. (Radhakrishnan, 2008, orig. 1923)

The Yoga tradition – traditionally having originated from Patanjali’s foundational and highly aphoristic Yoga-Sutras – is a psychological and spiritual treatise that discusses cognition. It accepts the psychology and metaphysics of the Sāmkhya tradition and so all that we explained above also holds here. The Yoga, like the Sāmkhya, speaks of the five states of the mind (*vṛttis*, that is) – *pramāna* (right knowledge, obtained from sense perception), *viparjaya* (error, stemming from false knowledge and incorrect apprehension), *vikalpa* (imagination or metaphor, where the usage of words is devoid of an actual object), *nidra* (the state of sleep where there is no content) and *smṛti* (memory). Yoga uses the term *samskāra* to refer to sense-imprints and memories – the former when the object is present and the latter when the object is absent. (For all purposes, these can be thought of as recorded impressions though it is entirely possible

that they are not stored as-is.) It is held by Yoga that mind (*mānas* or *citta*) is reflective in nature – tending to reflect within itself whatever it perceives thereby making it available to the ego-sense (*ahamkāra* or *asmita*). A thing – which, according to Yoga, always consists of the three *gunas* – is known by the mind only when the latter notices the former and the former is said to exist independent of its being noticed by the latter. When the mind consciously focuses on a certain place or environment, it is said to be in a state of *dhāraṇa* (concentration or, technically, attentional control); when it focuses upon a singular object unwaveringly, the state is *dhyāna* (meditation) and when the ‘I-ness’ or ‘ego-sense’ is not cognized anymore and the act of cognition itself becomes unconscious, the state is *samādhi* – when the knower merges with the known. And it is through this *samādhi* that insight (or *prajñā*) arises. It is interesting to note that Yoga draws a line of distinction between the act of perceiving an object and the act of ascribing the instrumentality of the act to the ego-sense. The aim of the spiritual aspect of the Yoga therefore is to achieve this sublime state by the ‘restraint of the sense-impressions’ which disturb the mind ‘as waves rippling on the surface of still water’. (Radhakrishnan, 2008, orig. 1923; Sharma, 1987; Bryant, 2009) Although any discussion on Yoga is philosophically incomplete without a description of the practices which lead to this state, we do not discuss them as they are beyond the scope of this paper.

### IV. The Nyaya-Vaisheshika tradition

Since it is difficult to describe in short the traditions of the Nyāya and Vaisheshikā which represent the analytical traditions of Indian philosophy, we discuss only the relevant sections. Nyāya – sometimes called *hetuvidyā* (the science of reason on which the validity of an inferential argument depends) – literally means that by which the mind is led to a conclusion. It is hailed as *pramānshāstra* – the science of correct knowledge. According to this theory, all knowledge implies four conditions: the subject, the object, the state of cognition and the means of knowledge (Radhakrishnan, 2008, orig. 1923). ‘Every cognitive act, valid or invalid, has the three factors of a cognising subject, a content or a what of which the subject is aware, and a relation of knowledge between the two, which are distinguishable though not separable. The nature of knowledge, as valid or invalid, depends upon the fourth factor of *pramāna*. It is the operative cause of valid knowledge in normal circumstances.’ (*Nyāyavārttika*, i. 1. 1, trans. Radhakrishnan, 2008) Radhakrishnan (2008, orig. 1923, pp. 31) points out that Western treatises on logic do not generally treat of perception, but the Nyāya in contrast regards it as one of the important sources of knowledge. The Nyāya system considers two different kinds of perception: determinate (when you perceive and recognize it) and indeterminate (when you perceive but do not cognize the object). Sharma (1987) remarks that these are not ‘kinds’ of perception; they are merely stages in the complex process of perception, a view that we agree with.

The Nyāya system considers the indeterminate perception as the starting-point of knowledge production although it is not always held as being synonymous to knowledge – an aspect we shall later imbibe in our discursive model of cognition. It is the stage when the distinction of true or false does not apply and the logical issue does not arise (Radhakrishnan, 2008, orig. 1923). (We do not discuss inference here as it is beyond the scope of this paper.) The third kind of cognition, *upamāna* or comparison, has been defined as the knowledge of the relationship between a word and its denotation. For example – when we identify an object even if we’ve never seen it before but because it has been described to us before. The fourth kind of cognition, *shabda* or verbal testimony, refers loosely as a trustworthy statement spoken as a meaning collection of words, a sentence that is, taking into consideration the relevant semantics and pragmatics, etc.

The Vaisheshikā philosophy is a pluralistic realism which emphasizes that diversity is the defining nature of the universe. The term Vaisheshikā is derived from *visheshā* which refers to the particularity of all objects. The Vaisheshikā tradition provides the necessary ontological framework for the Nyāya tradition as the latter lends its epistemology to the former. Sharma (1987) considers the Vaisheshikā categories – distinct from the Aristotelian, the Kantian and the Hegelian categories – as being a metaphysical classification of all knowable objects or of all reals. These categories consist of substance (*dravya*), quality (*guna*), action (*karma*), generality (*sāmānya*), particularity (*visheshā*), inherence (*samavāya*) and non-being (*abhāva*). Of these we focus on generality or *sāmānya* as it is quite relevant in the current context. This generality is defined as a class-concept or a universal – the common character of the things which fall under the same class. It stands, not for the class, but for the common characteristic of certain individuals (Sharma, 1987). In other words, we construct our own ontologies bottom-up by finding common aspects of discrete objects rather than having them defined top-down right at the onset. The mere fact that philosophers and computer scientists struggle with the definitions of upper ontologies but are not overwhelmed by particularity strongly hints at the fact that our minds are more acquainted with the lower details of ontology than the upper levels, if at all.

## V. A generic discursive model of cognition

We present below a generic discursive model of cognition below based loosely on the four philosophical traditions discussed above and our conception of the three spaces. This is a rudimentary model that leaves much space for further addition. Moreover, the affective and executive aspects of an agent which we believe are integral to cognition are not shown here. This section describes the various faculties and how the cognitive processes work in an abstract manner. (See Figure 2)

Our basic framework derives heavily from the Samkhya architecture of the human cognitive system. We refrain from calling this a model of the mind because the Western

conception of the mind and the Indian conception of the mind are different. In the latter, the mind is only a part of the entire system. The *discriminant* and the *ego-sense* are not technically parts of the mind; they are separate but are strongly coupled. *Manas* (or the Lower Mind, as is often called) manages the five cognitive senses – that of vision, hearing, smell, taste and touch. It is often held to be a sense organ in its own right. Here the sensory data is assimilated and a discrete object is perceived. (The *manas* also coordinates the executive faculties – those of movement, speech, etc. – but they are not depicted here for the sake of simplicity.) The *lower mind* receives as input from the cognitive senses individual discrete objects. This is where attention comes in. A unique feature of this model is that when an agent first comes into contact with an environment, it uses attention to perceive the environment in a discrete manner. It does not view the world as a video footage (sort of) or as a sequence of moving frames or images. Rather, attention causes the lower mind to affix itself to any one of the cognitive senses at any given point of time and the perception of the object in the sense organ is relayed back to the lower mind. In this way, attention causes rapid iterations between the lower mind and the sense organs thereby constructing a set of discrete perceptions. Attention is induced or diverted – we are attracted or distracted, that is – because of the *ego-sense*. The *ego-sense* is the only autonomous faculty within the cognitive system. We borrow from our basic philosophical traditions when we attribute to it the tendency to be continuously swayed by sensory input and be drawn to it by means of attention. It is, as shown in the model, the centre of autonomy, the seat of will or intention and the directing faculty of awareness. Attention is drawn to the cognitive senses by their ‘attention directors’, as shown in the model. When we are reading a document, say, the *ego-sense* and the *manas* are affixed to the organ of vision. It does not mean that sensory input from the other organs is absent. It merely signifies that we are focused on one single thing. Now if, say, we hear a very loud noise from outside the window, we will obviously be distracted and the *ego-sense* will detach itself from the organ of sight to the organ of hearing. And even if our eyes are still on that document, we won’t be actually reading it anymore for a split-second as ‘our attention will be elsewhere’. This distraction can be instigated by all the five senses: vision by the intensity of light, hearing by the volume, say, etc. The *discriminant*, as the name implies, refers to the power of discrimination. This faculty is the store-house of sense-impressions (again, not an as-is video footage) and memory, and its function is to discriminate between perceived objects.

So how do these fit together? When my attention is drawn by a particular cognitive sense organ, my *ego-sense* directs my *lower mind* to affix itself to the relevant organ and perceive the object. The *lower mind* obliges and produces a perception of the object through my eyes, say. This is relayed onto the *omniverse of discourse* (which can be thought of for now as the context) – a region accessible to the *ego-sense*, the *discriminant* and the *lower mind*. But

this is an indeterminate perception – there’s something there, but I don’t know what it is. This is the first stage in our perception process. As soon as this is perceived, the *ego-sense* claims subjectivity – ‘I’ am ‘aware’ of something (although I do not know what it is). This is the second stage of perception. This is where the *discriminant* comes in and matches it with its store of sense-imprints and comes up with an identifying name: ‘pencil’. This is determinate perception and so now I am aware of a pencil which is the third (and presumably final) stage in perception and the *discriminant* records my subjective experience of being aware of a pencil. But this is NOT to say that I am aware of the fact that I am seeing a pencil. There is a subtle and critical difference between the two! Up till now, I have not ‘thought’ anything nor have I expressed something. So technically I cannot describe what processes my mind has undergone. In order to express the fact that I am aware of something, I require the use of language (or any representation scheme). I need to realize how I became aware of the pencil – my organ of vision. It is only after the *ego-sense* consults the *discriminant* a number of times before I am able to assert that ‘I can see a pencil’. The acknowledgement of the process of perception is a conscious act which is the fourth stage of perception.

So the steps are something like this:

1. A particular sense organ requests attention from the *ego-sense* (from me, i.e.).
2. The *ego-sense* (I, i.e.) directs the *lower mind* to affix itself onto that particular sense organ.
3. The *lower mind* perceives a discrete object (indeterminate perception).
4. The *ego-sense* assumes subjectivity and the subjective experience of being aware of something arises. (‘I am aware’ of something.)
5. The *discriminant* ‘recognizes’ the perceived object, say, as an apple.
6. Current state of my mind → ‘I am aware of an apple.’

It is not that attention is compulsory for perception nor is it that the perceived object is determined only after the *ego-sense* assumes subjectivity. For instance, when in a car speeding along a highway in Japan (say!) and staring out absent-mindedly at the signposts, it is a common observation that our eyes will glaze over the strange symbols but notice the English ones even when we’re not explicitly looking for them. This is because even when the *ego-sense* is not explicitly requesting the *lower mind* to perceive objects, the latter still keeps on receiving sense-impressions from the world (as long as the channels are available, i.e.) and submitting them to the *discriminant* for identification which then takes the liberty of discarding unknown symbols and raising an alarm (figuratively!) when it recognizes familiar symbols and causes the *ego-sense* to direct its attention to the object in question. So in this case we see how the perception of an object and the

determination of the perceived object are accomplished even before we are aware of it.

However, whatever we have discussed till now is the perception and awareness of objects in our environment; we have not explored the foundations of thought processes. So this, we hypothesize, is the limit of perception, in that it causes a subjective awareness of perceived objects only. In order to reflect on these perceived objects, to relate or associate them, one is required to engage in discourse – an issue we address in the following section.

## VI. A discursive theory of cognition and knowledge

What is discourse? We define discourse as a generic form of communication whose conception supersedes those of dialogues, dialectics, conversations or even written forms of communication involving the use of a certain representation scheme held by and with agents who may be spatially or temporally separated. We extend this definition to include not only the communication but along with it the circumstances which present themselves as demanding some manner of communication either in between two or more agents or even between an agent and itself. Neither is there a word that we read or write nor a word that we hear or we speak that finds itself lacking of membership in a discourse.

Therefore when we wish to convey some knowledge to other agents, we use information – the bearer of knowledge and the discursive vehicle – codified often as linguistic statements, which is then interpreted by those agents. All entities in the Information space therefore are elements of some discourse; all that is known therefore is through discourse itself. The cognitive process described in the previous section enables us to be aware of physical objects only. But with the discursive process, these discrete perceptions within the Knowledge space are projected back onto the Information space to form entities (in the form of linguistic assertions), for which there exists no equivalent in the Physical space. What do we mean by this? It is by the process of perception that I cognize (through *manas*) and recognize (through the *discriminant*) two discrete objects or entities: ‘a horse’ and ‘an apple’. But it is only through discourse that I assert: ‘Horses love apples’. Horses and apples both exist in the Physical space. But the assertion ‘Horses love apples’ does not exist in the Physical space although it exists as an element of discourse in the Information space. The construction of the above sentence requires the knowledge of how sentences are built (grammar, i.e.), the fact that the terms ‘horse’ and ‘horses’ refer to the same class of objects differing only in number (likewise for ‘apple’ and ‘apples’) and the semantic meaning of ‘love’. These are not innate; no human is ever born with this knowledge. Therefore it follows that the ability to engage in discourse is more fundamental and primary than knowledge acquisition and language acquisition. So the problems of defining exhaustive ontologies and of embedding innate grammar in intelligent

agents are actually one and the same. If an agent can engage in discourse, it can resolve both these issues by itself. That is where true sentience can be hypothesized to reside. But here we have referred only to the contents of discourse; in the next paragraph we explore its situational aspect.

We hypothesize that there exist innumerable numbers of discourses in the world, nested in a manner not unlike hierarchical tree-like data structures in computer science. That I am engaged in intense thought about the processes of cognition employing the rules of inference can be thought of as my discourse with myself. That I am typing out my thoughts in the form of sentences on my laptop is a larger discourse that encompasses the previous one. This, in turn, is part of an even larger discourse, namely, that of my intellectual pursuit along this particular line of inquiry in the disciplines of cognitive science. And this in turn is part of my academic endeavors in order to advance my career – an even larger discourse, say discourse D1. A sub-discourse of this D1 can be that I am associated with my institution engaged in higher studies and required to interact with other academics. Sub-discourses of this may include each of the projects that I am involved in with other academics. But this is only one way of imagining it. Say, engaged in my immediate discourse (that of writing this paper), I suddenly am asked by someone about a football match. In such situations, we ‘switch contexts’ or, as we put it, enter a different discourse. And having dealt with it, we return. The mind, it therefore can be conjectured, is not a Turing machine; it does not work on an endless sequence of input on an infinitely long tape. Nor is it a video analyzer which breaks all perceptions of the world into frames and arranges them along the temporal co-ordinate and then try to find patterns for recognition. All knowledge is centered on and arranged according to discourses.

A discourse, therefore, is a cognitive phenomenon that has as its focal point an object of attention and perception common to the agents engaged in it. In the discourses discussed above, the paper I’m writing now is an object of perception and subsequently, of discourse; likewise, the football match is another event-object that I and my friend have perceived, be it directly or indirectly, which forms the focal point of our discourse. So what generally confuses us as the ‘train of thought’ is actually the attention of the *ego-sense* flitting from object to object – our focus shifting from one discourse to another. (So we should maybe refer to it as the ‘train of discourse’ instead!)

Having said the above, we are now in a reasonable position to return to our model and explain what we meant by the term ‘*omniverse of discourse*’. The omniverse of discourse refers therefore to all the ‘universes of discourse’ that an agent has engaged in till now. It is hierarchically arranged and created bottom up (not top-down!). We mentioned before that the *lower mind* was a sense organ too and by dint of its being a sense organ it can therefore attract the *ego-sense*’s attention onto itself. But by ‘itself’, we mean the omniverse of discourse itself, or more

specifically, a particular discourse. These discourses, in our model, are not stored anywhere else; they are always actively awaiting the *ego-sense*’s attention, connected to the *discriminant*, the *ego-sense* and the *lower mind*.

Our memories, it therefore can be inferred, are also arranged according to the discourses we engage ourselves in. Discrete perceptions (objects or words) serve as pointers to discourses. The perception of an object or a word, as we highlighted before, consists of a denotation and a connotation. The connotation acts as a *selector* to a particular discourse in the omniverse of discourse, not quite unlike the *chip-select* signal in a multiplexer. And discourses in turn serve as pointers to our recollections, not quite unlike indexes in databases. (Compare the psychology of the adage, “Out of sight, out of mind.”)

The selection of a discourse therefore we have seen depends on the perception of an object. But the thoughts that ensue require linguistic expression. One cannot think, one cannot reason, one cannot express if one does not know how to. And on this issue, although we are not in a position to experimentally verify our claim, we can conjecture that the principle of linguistic relativity holds (if at all) only for the ‘train of thought’, once we have entered a particular discourse; but not for the ‘train of discourse’ which is guided by perception and devoid of the influences of language.

Ideas are not all that central to knowledge nor are concepts; the central and defining aspect and substratum of all thought and all knowledge therefore is *discourse*.

## VII. Sentience and Thought

We have already discussed how thought is initiated from a discourse in the previous two sections. But how does one think? What sequence, if any, does one follow? Thought involves perceived objects; thought associates them, manipulates them, etc. The laws of logic and the rules of inference are not things which are innate. Some are implicitly acquired; some are explicitly acquired. But an association of discrete objects and the application of rules of logic and inference which are conceived, expressed and learnt through language require the same linguistic capability. Thought, as explained in detail before, is nothing but self-discourse – where the *ego-sense* is engaged in discourse with itself. The only difference is that in discourses involving multiple agents there is a possibility of the connotation distracting the agent’s current domain of discourse or leading it to misinterpret the information being conveyed. In self-discourse, these two situations do not arise. We know exactly what we are thinking and we are fully focused on our thought. In our model described and discussed above, thought is a state of mind when the attention is on the *lower mind* (in effect, the omniverse of discourse) and not on the sensory input.

Sentience is a term often used in the contexts of artificial intelligent agents and also of science fiction. What constitutes the sentience of such an agent is often debated. Is an agent considered intelligent or sentient if it passes the

Turing test (Turing, 1950)? Or would the Chinese interpreter in Searle's famous thought experiment oppose the idea? (Searle, 1980) Would the chat-bots on the internet qualify as sentient? Would an agent be called sentient if it fooled a human into thinking it is human as well? Having described a discursive model of cognition, we would prefer to define sentience as the ability to engage in discourse. This definition, in our opinion, clearly distinguishes human beings and all manner of intelligent agents conceived, designed or built to this day.

### VIII. Conclusion

"The prospect of representing everything in the world is daunting." (Russell & Norvig, 2003, pp. 348) Of the myriad problems arising from the epistemological issues confronting cognitive science, the knowledge representation problem is 'both formidable and central to the enterprise' (Stillings et. al., 1995). Through this work, an attempt has been made to pave the way for a better understanding of knowledge and its representation. It is hoped that this discursive hypothesis will aid in our understanding our knowledge representation and acquisition. It may be, as Stillings et. al. (1995) point out, that our hypothesis turns out to be wrong but we hope it aids in the formation of other more-close-to-true theories based on earlier attempts, if that be the case.

In the present work, we have explored the nature of cognition, the processes by which we perceive various objects and how knowledge may be acquired. In the course of our inquiry, we have found a striking significance of discourse in the process of cognition which has led us to conclude that it is one of the fundamental factors in knowledge acquisition and representation. As mentioned before, this work is a shorter version of an extended work currently in progress. This discursive model of cognition is part of a larger framework that links cognition, affection and conation together as a seamless whole. We hope to be able to discuss this larger framework in our future works.

If one looks closely about the world, one is sure to notice the influences of discourse on other spheres of life and other disciplines of the world. Books also fall into our

category of discourses – a discourse between the author and all the readers. Discourses find their ways in religious texts often setting examples of faith, belief, tradition, ethical standards, etc. The world of logic, of argumentation and of dialectics is grounded in the world of discourse. In the age of the internet and the World Wide Web – where social networking, online forums, communication and interactions, etc. are widespread – one hardly needs to stress the universal nature of discourse. Discourses are everywhere.

Lastly, we draw an interesting (although slightly irrelevant) parallel from the Rig Veda – an ancient text of Indian origin – which frequently lauds and offers prayers to Vak, the ancient Vedic goddess of speech and utterance widely identified with the later Hindu deity Saraswati, the goddess of knowledge and creation. In spite of this highly fascinating note, in reality, whether or not discourse bears such a close relationship with knowledge and whether or not the ancient Indian seers were aware of such a connection or even its possibility, one can only wonder.

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## Illustrations and Figures

### ***A Generic Discursive Model of Cognition (Bhattacharyya, 2012)***

