What is Science?

Donald J. DeGracia, Ph.D.

How yoga helps us understand science

PLANETALK
ABOUT THIS AND THE OTHER WORLDS

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This work is dedicated to Marvel Comics, for blurring the distinction between fantasy and reality…in a good way.

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INTRODUCTION

Since the prelude is really an introduction of sorts, here I want to just say a few words about the intent and the basis of *What is Science?*

The intent of this essay is to explore how the Hindu experience of yoga can help us better understand Western science. My comments at the start of Part 7 capture the spirit of this work:

"While I am sometimes critical of the West, it must be recognized that what is going on here is the attempt to have the two world views shed light on each other. It may not be an equal illumination from both perspectives, but both contribute to illuminating a synthesis that transcends either."

That's the intent in a nutshell. As with my previous works, this one too is about building bridges; about unifying and synthesizing what otherwise seem to be disparate and unrelated world-views, in this case yoga and science.

As to the basis of this essay; on what grounds I stake my claims, I say the following at the very end of the essay, in Part 10. But it seems appropriate to also say it at the beginning so the Reader can appreciate my basis from the start. As to the validity of the claims of yoga:

"All I know is I have had some of the more elementary experiences that they teach. I then infer that the more advanced practices will work as advertised. This is analogous to when I was a freshman undergraduate. Although I knew nothing of advanced molecular biology, other than that it existed, I was confident that if I proceeded step-wise, I would eventually learn the advanced stuff. And that has come to pass, and is now how I earn my paycheck. I have no reason to think it will be different with the yogic methods and techniques. Therefore, I have no problem using their ideas as intellectual fodder to construct the arguments put forth here."

In short, because I have had experiences with altered states of consciousness (detailed in my other two free online books DO_OBE, and Beyond the Physical), I have come to accept the yogic framework as a legitimate, in fact, as *the* legitimate framework for explaining altered states of consciousness.

I do not discuss my personal experiences in this work. Nonetheless, the essay discusses technical knowledge that stems from experiences in altered

states of consciousness. When necessary, these are described as lucidly as possible. However, if you have not had these types of experiences, then you have no basis to criticize. You wouldn't just walk in a chemistry lab, with no training in chemistry, and start arguing with the chemist. Even though altered states occur in the mind, the same principle applies. Mathematics also occur "only in the mind", and no one is going to criticize math on this basis. I will not resolve such issues here and we get deep into them in the essay.

Finally, some "housekeeping" remarks…There are several versions of *What is Science?*

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Otherwise, thanks for reading and I hope you find the essay informative.

Don DeGracia
Detroit, MI
May, 2014

PRELUDE: WHY EVEN TAKE HINDU THOUGHT SERIOUSLY?

Summary: Some of the great achievements of Hindu thought are explained. Key notions that will play a crucial role throughout the essay are introduced, such as the notion of "gunas".

I am feeling somewhat self-conscious as I release the 10 part essay that uses yoga to explain Western science. What gives me the right to do this? Am I just some naive chump who buys into any old fairy tale?

Well, no. The reasons for invoking Hindu thought, which is where yoga comes from, are compelling. I've been studying Hindu thought since about 1985, so about 30 years. Over this same time I have been studying Western science. Further, I don't just study, but practice both. I am a practicing scientist; it's how I earn my paycheck. And I practice methods that fall under the yogic techniques. Over 30 years I have held these two views side by side in my mind, and lived both viewpoints in my daily life. Here, I want to offer only a cursory and small defense of my position.

A BIT OF HISTORY

The British invasion of India that began in the mid-1700s was the first true contact of the modern West with the ancient culture of Bharat (see here). Of course, at the time, these dark skinned people were pagan heathens. Their one salvation was a bountiful land and rich country for which it was the "white man's burden" to step in and see to it that such resources were properly utilized. Under the conquest of the Brits, over time a legitimate academic culture of "orientalism" sprung up and scholarship in the Indo-Aryan cultures began in earnest. Perhaps up to the 1940s, the teachings of Hindu India were studied from the point of view of the superiority of Western traditions with their roots in Athens, Rome and Christian Europe.

This is to say Hindu thought has never in the West been accepted as being on par with Western thought. It has generally been merely another specimen subjected to the Western methods of intellectual analysis. It was only in counter-cultural movements, themselves gestated in the British Empire, where pockets of understanding flowered that saw Hindu thought not even on par to Western thought, but decidedly superior to it. I refer to the Theosophical movement, started in the 1870s under the Russian mystic Helena Blavatsky. Over one hundred years later, such sentiments are still counter-culture in the West. To this day, Hindu and Western thought are not put on equal footing.

Therefore, I list here a few of the accomplishments of the Hindu thinking that show they somehow had access to understanding that has only been rediscovered in the 20th century in the Western cultures, or whose influence has become so pervasive in Western thought that it is generally forgotten that the ideas came from Hindu India.

WHAT HAVE THE HINDUS EVER DONE FOR US?

1. Zero. Where would we be without zero? Compare to the dumb, literal Romans who needed a symbol for every single place in a number. Where did the Hindus get the idea of zero? Even today the origin of the concept of zero is ill-understood in the West, in spite of the massive advances in Western math over the past several centuries.

Zero derives from a core tenet of Hindu philosophy that usually is today translated as "unmanifest" and contrasted to manifested existence. "Nirguna" is one Hindu term for unmanifest. It means, "lacking the gunas". The gunas are what everything manifest is made from. In the West we think of everything as made of patterns of energy. This is exactly what the gunas are, although the gunas concept has much broader implications, as discussed throughout the essay.

If everything that is manifest is made of gunas, then there can be a state "without the gunas", and this state is translated into English by the word "unmanifest". It is a bizarre concept of something that, in some sense exists, but does not exist in the realm of manifested, overt existence. It is the state of being that has the value of "no being". This is similar to how we think of zero. Zero is a quantity: it is the quantity that is "no quantity". Nirguna is the state that represents no state. The notion of something that in one sense exists and, in another sense, does not exist is a core theme in Hindu cosmology, and an idea like zero arises naturally from this basis.

2. Infinity. Yes, infinity is an explicit facet of Hindu thought. Even the basic arithmetic of transfinite numbers was understood in Hinduism. The Hindu idea for infinity is "Brahman". This term means "everything". There is nothing that is not Brahman. The manifest, the unmanifest, it is all Brahman. There is only Brahman. And Brahman is the very definition of unlimitedness. Nothing limits Brahman. Not words, not concepts, not time, space, or any quality. In the West since the time of the ancient Greeks was the debate over potential and actual infinity. To the Hindu mind, actual infinity exists, we are inside of it, and it is Brahman.

Further, contemplation of the nature of Brahman led to ideas identical to transfinite arithmetic. Consider the following excerpt from this web page (note this is a quote within a quote):

> "Bhaskara wrote over 500 years after Brahmagupta (Brahamgupta wrote in 630 AD). Despite the passage of time he is still struggling to explain division by zero. He writes:-
>
> > 'A quantity divided by zero becomes a fraction the denominator of which is zero. This fraction is termed an infinite quantity. In this quantity consisting of that which has zero for its divisor,

> there is no alteration, though many may be inserted or extracted; as no change takes place in the infinite and immutable God when worlds are created or destroyed, though numerous orders of beings are absorbed or put forth.' "

From Bhaskara's quote, it does not seem to me he is struggling. He seems to understand perfectly what a number divided by zero means. He says quite clearly that adding a finite quantity to infinity returns infinity. Hindus understood this well before Cantor proved it in modern terms. As the quote illustrates, Hindus understood basic transfinite concepts by contemplating the nature of Brahman.

3. The Big Bang. There are several points of overlap with Hindu and modern cosmology. Both agree the Universe is really, really old, and it began in a condensed state where, the condensed state contained the entire future of the cosmos. The Contributors to the Wikipedia page on Hindu Cosmology did a nice job explaining the same ideas I only outline here.

3A. The Hindu conception of time. It is vast. A single universe, such as what we currently inhabit, is said to have a life of 4.3×10^9 solar years, or 4.3 billion years. We currently know with some reliability that the universe is about 14 billion years old and will continue on for some time. According to one current estimate, the universe may exist for some tens of billion more years. The ancient Hindus appear to have been off by perhaps a factor of 10. That in itself is pretty amazing for an ancient culture. However, the 4.3 billion year span is called a "kalpa" or a "Day of Brahma" (note, NOT Brahman, but Brahma, the creator of universes). The Hindus do not stop at one kalpa. In Hindu cosmology, a single universe is not the ultimate extent of manifestation. Existence lasts 100 Brahma years, which is 311 trillion solar years. Thus, our current understanding of physical cosmology lags the Hindu estimate.

3B. Existence began in an "egg" called Brahmanda. It is worth quoting directly (from here) so the Reader can appreciate the elaborateness of the Hindu conception of creation. I know it has a lot of unfamiliar words, but try to read it anyway:

> "The transformation of Maha Purusha and his 'alter-ego' Prakriti i.e. the Kshetrajna and Maha Tatwa led to the **Brahmanda** or the Golden Egg in which sat the Four Faced Hiranya Garbha-Brahma, the Creator. Within the Golden

> Egg, are situated Seven Lokas, Prithivi, Seven Samudras and Seven Dwipas, Massive Mountains and Thousands of Rivers. Within the Golden Egg are the Sun, Moon, Stars, Planets, Wind and Lokaloka. While there is an enclosure of water as huge as ten times more around the Golden Egg, there is ten times more of Tejas or Radiance surrounding the water. Ten times larger than the enclosure of Illumination is of Vayu (Wind). Around the enclosure of Wind is that of Ether (Akaasha or the Sky) which is ten times more of Wind. Even enveloping the enclosure of 'Nabhas' or Ether is that of 'Bhutadi' (Ahamkara or Ego) and that too ten times larger. Yet another enclosure to Bhutadi is ten times more of Nabhas , but that of 'Mahat' is equally bigger to Bhutadi. Filnally, Mahat is surrounded by 'Pradhana' or the Supreme. Thus there are seven enclosures around the Cosmic Egg viz. water, radiance, wind, ether, Bhutadi, Mahat and the Pradhana the Unknown; all these 'Avaranaas' cling to each other."

A few points are relevant to modern minds steeped in the Big Bang theory of the creation.

First, note how the entire universe and its future is contained in the egg. There is the "…the Sun, Moon, Stars, Planets". The Brahmanda, like any egg or seed, contains the future potentiality of the full-grown creature. This is a more natural way to express the idea used in modern cosmology that the Big Bang contained all the necessary conditions for the present universe and then followed a deterministic trajectory to the present, and beyond into the future.

But the Hindu idea of creation is much vaster than our modern view. "Within the Golden Egg, are situated Seven Lokas…", and I can stop quoting here. The idea of the Seven Lokas refers to all the states of matter, not just physical matter. What we call the universe is the lowest, the bottom of the 7 lokas, which is called the "physical plane" in contemporary occultism. There are 6 other levels to the universe of which modern science is completely unaware. We return to this idea in Part 9 when we introduce Hindu cosmology.

Second, we note that there is a description of what created the singularity:

> "The transformation of Maha Purusha and his 'alter-ego' Prakriti i.e. the Kshetrajna and Maha Tatwa led to the Brahmanda."

This requires some translation. Maha Purusha and Prakriti refer to something called the Shiva-Shakti Tattva in other Hindu traditions. This refers to processes that occurred well before manifestation, or, in modern terms, before the Big Bang. It refers to the fundamental separation in consciousness of the observer and the observed. This act is considered in Hindu thought to be the most primordial act of creation. In some ways, it is analogous to the "Fall from Grace" taught in Christianity. The possibility of a mental act preceding creation of the physical universe is outside the scope of modern cosmology. But this is what Hindus teach is responsible for the Big Bang. We come back to the Shiva-Shakti Tattva in Part 10, when we discuss the relationship between knowledge and power.

The other interesting aspect is that the singularity, the Brahmanda, did not exist by itself. An elaborate description is given of seven layers, or "screens" (avaranaas) surrounding the Brahmanda. The magnitudes involved are logarithmic: each screen is 10 times the size of the previous, so the largest screen 'Pradhana' is 10^7 times larger than the first screen, 'water'. To liberally translate these into more modern terms:

[1] A fluid-like layer, perhaps a quark-gluon plasma fluid? ("water").
[2] A layer of radiation ("radiance").
[3] A layer of force ("wind").
[4] A layer of space ("ether")
[5] A layer of the cosmic primordial elements (Bhuta means "element")
[6] A layer of a cosmic force akin to electricity (electricity, it is taught, is the lowest manifestation of Mahat)
[7] A layer of, for lack of a better term, the dynamics of creation. We consider what this means in point 4:

The above list sounds very similar to the time sequence of events since the Big Bang in standard cosmology (see graphic). The Hindu description suggests they are simultaneous. From the standpoint of general relativity, all space and time can be thought of as simultaneous, as forming a block universe. From that vantage point, the Hindu and modern views match.

4. Dynamics. This one is super-important, so please pay attention. Hindus discovered dynamics long before the West. Dynamics, as a branch of physics, was started by Leibniz when he discovered kinetic energy. Today,

dynamics is a general science, where we have found three main types of dynamical patterns in nature. We call these "point attractors," "periodic attractors," and "chaotic attractors". The latter, chaos, came of age really in the 1980s even though it had been described by Lorenz earlier, and others such as Cantor and Poincaré had also understood aspects of chaos around the beginning of the 20th century (some good history here).

But at least as far back as 250 AD, if not farther back, Patanjali, in the *Yoga Sutras* described the gunas. Patanjali did not invent the idea and they predate him. There are three gunas: satva, rajas and tamas. We can readily understand the gunas in terms of attractor state dynamics. Satva refers to dynamic systems with a limit cycle attractor. Rajas are dynamical systems with chaotic or strange attractors. Tamas are dynamics with fixed point attractors. This is summarized in the following table:

Guna	Type of attractor state
Tamas	point attractor
Satva	limit cycle
Rajas	strange attractor

Obviously, the Hindus did not use the mathematical apparatus we use today to define these concepts. Instead, they understood the concepts qualitatively. Today, the diversity of qualities associated with each guna makes it difficult to clearly see the connection with dynamics.

However, the identification of the gunas with dynamical systems is so important a topic in the scope of this essay that I want to quote the source that made this connection. It was I.K. Taimni who, in 1961, clearly linked the gunas to dynamical patterns in his book The Science of Yoga. Here are the relevant excerpts:

> "Although the theory of Gunas is one of the fundamental doctrines of Hindu philosophy it is surprising how little it is understood. The Gunas are referred to over and over again …and yet, nobody seems to know what the three Gunas really stand for. There is a vague idea that they have something to do with properties because the word Guna in

> Samskrta generally means a property or attribute… But one looks in vain for any clear exposition of the real significance of the word or what it really stands for in terms of modern thought."
>
> "The advances which have taken place in the field of physical sciences and the light which this has thrown on the structure of matter and the nature of physical phenomena has now placed us in a position to be able to gain a faint glimpse into the essential nature of the Gunas."
>
> "If we analyse the flux of physical phenomena around us in the light of modern scientific knowledge we shall find three principles of a fundamental character underlying these phenomena. These three principles which ultimately determine the nature of every phenomenon are all connected with motion and may be called different aspects of motion. It is very difficult to express these principles by means of single words, for no words with a sufficiently comprehensive meaning are known, but for want of better words we may call them: (1) vibration which involves rhythmic motion of particles [satva], (2) mobility which involves non-rhythmic motion of particles with transference of energy [rajas], (3) inertia which involves relative position of particles [tamas]. These principles are really the three fundamental aspects of motion."

The bracketed comments are mine. Indeed it is hard to put these concepts in words. That is why one requires the machinery of mathematics to express the dynamical states in a clear and unambiguous fashion.

So, the Hindus see all of nature as being made of the three gunas. This is really amazing when you compare it to the Western ideas that began with the ancient Greeks. The ancient Greeks started the tradition of thinking that the things in the world were made out of substances. "Atom" is the ancient Greek word for "the fundamental unit of stuff out of which the world is made". The Greeks thought the world was made out of some kind of substance. This idea dominated well into the 19th century, and it was not until Einstein that the West realized that material substance was just patterns of energy.

Compare this to the fact that from ancient to modern times, Hindus never conceived the things of the world to be made of substances, but instead to be made of dynamical patterns, the three gunas. Furthermore, how the Hindus treat this idea has not yet made its way into Western science. The gunas are treated as analogous to the three primary colors red, green and blue. All possible colors can be derived from mixing red, green and blue in various proportions. Similarly, all possible states of matter and energy can be obtained by mixing the three gunas in various proportions. I kid you not; this is exactly what is taught about the gunas.

To the Hindu mind, things are not made of substances at all. Things – rocks, wood, chairs, people, clouds, stars – every apparently material thing is actually made of the three patterns of movement, the gunas, combined in different proportions. Hopefully, some smart dynamics person is reading this and can figure out how to implement the idea in terms of our modern dynamics.

SUMMARY

The above only scratches the surface. Let's summarize the above discussed, where Hindu though either influenced or predated our modern ideas:

[1] Zero
[2] Infinity and transfinite arithmetic
[3] The extremely long durations of the universe
[4] The Big Bang
[5] A theory of dynamics

Some of these ideas directly affected the evolution of Western thought such as the concept of zero. Other of these ideas could not even be understood until the advent of 20th century math and science, such as transfinite quantities, the extremely long time of the universe, and understanding that the gunas refers to dynamics.

In comparison, think of the British Christians who invaded India in the mid-1700s, who believed that the universe and all creation was 6000 years old, who believed that material things were made of atoms or some type of substance, and who believed the universe was the static creation of a God in Heaven.

Seriously, who is the barbarian in this picture?

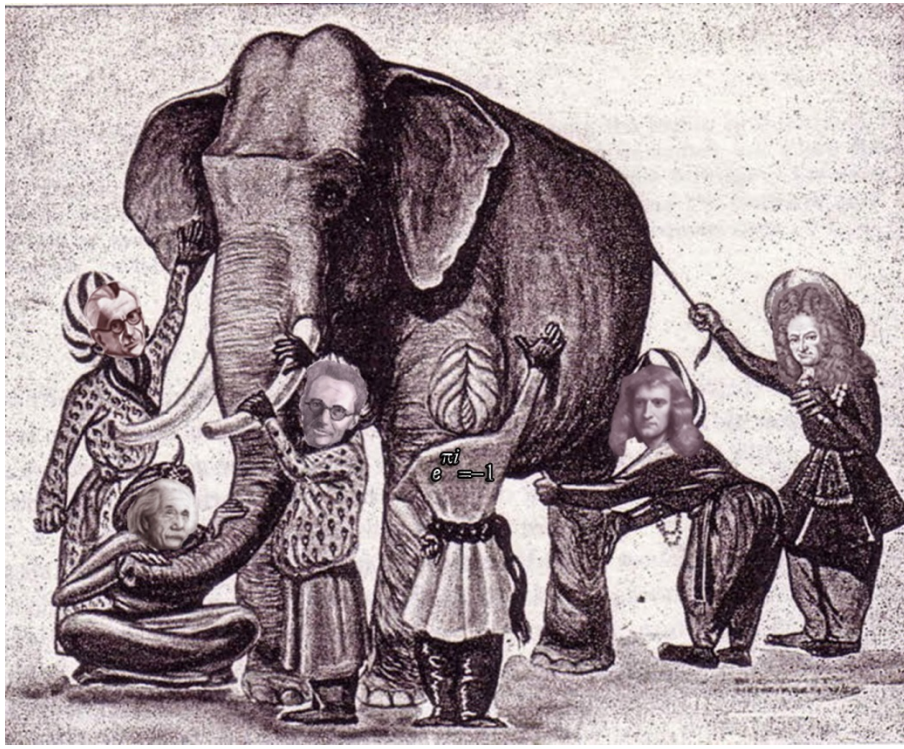
It is therefore natural to ask: how could the Hindu mind come to such a picture of the universe? Where did Hindu Cosmology come from?

Well, an idiot would say it was a coincidence, a lucky guess. Someone smarter than an idiot would perhaps invoke ideas of the collective unconscious, myths and archetypes, and aspects of the human unconscious that are constant across time; the Joseph Campbell way of thinking.

Someone who is not an idiot would just ask the Hindus where they got these ideas. And their answer would be: from yoga. The great Rishis and Sages of Hinduism, the authors of their so-called "holy books" were one and all practitioners of yoga.

So, it's not as weird or as dumb as it may seem at first glance to use the yogic ideas to understand science. In fact, it is something like a teenager asking his Grandfather for advice.

PART 1: THE DEMARCATION PROBLEM



Blind men feeling the elephant

Summary: Part 1 lays out our basis by trying to figure out how science is distinguished from other forms of human activity, which is called “the demarcation problem”.

FEELING THE ELEPHANT

What is science? The word “science” means different things to different people.

Are you a practicing scientist in a particular field of study? If so, science will mean something specific to you: your training, the topic you are studying, the overall community of scientists to which you belong, etc. Science is very different to a sociologist or a physicist.

Are you a lay-person with an interest in science but no formal training? Then you probably have learned about science reading books written for the general public, or by watching Discovery Channel, science videos on YouTube or reading science blogs.

Perhaps you are an academic specialist in a different field but with an interest in science. For example, maybe you are a historian of science, or a philosopher of science. In which case, again, you may have a specialized area of study, for example, the study of heat in the 17th century for a historian, or maybe you are interested in interpretations of quantum mechanics or neuroscience if you are a philosopher.

As these few examples illustrate, science is clearly a multifaceted thing. Like the Hindu idea of the blind men feeling different parts of the elephant, one sees science differently depending on where one "touches" it. Very importantly, one will understand science to the extent of one's intellectual capabilities. When I ask: "what is science?" I am thinking of the philosophy of science problem of trying to define the nature of what science is as a human activity. In the philosophy of science, this is called the "demarcation problem".

THE DEMARCATION PROBLEM

The Wikipedia entry on the **demarcation problem** is a reasonable introduction to the topic. It describes the main ideas of the topic. Let's briefly outline what people have thought about the nature of science:

Common sense view – The common sense view is that science objectively describes nature. Different fields of science describe different aspects of nature. Physics describes time, space and energy; chemistry describes material things; biology describes living things; psychology describes how minds work, and so on.

Positivism – Positivism attempted to refine the common sense view of science. The essence of positivism was the "verification principle", which

stated that any truth had to be verified by experimental evidence or deductive proof. Positivism had the grand ambition to explain everything in terms of science and math. There were two main problems with positivism: (1) one cannot verify the verification principle, and it must be accepted as a matter of faith or belief, and (2) we must, by necessity, ultimately always describe experimental evidence and deductive proofs using regular human language. Language, however, is not, in general, scientific.

Post-Positivism. "Post-positivism" refers to a diverse set of ideas about science that do not accept that science is 100% objective. The focus has been mainly on how language and culture affect science. Even though scientists make up their own specialized languages to describe nature, these languages are still embedded in our everyday languages, and our everyday languages are a product of our culture and society. We'll discuss only the most widely known view as an example.

Thomas Kuhn was a very influential post-positivist philosopher. He invented a new way to understand science in terms of things he called **paradigms**. Paradigms are all of the social and psychological aspects of science that are present *along with* the regular (inductive) scientific facts and (deductive) theories.

A paradigm is kind of like an intellectual iceberg. We all know you only see the tip of an iceberg sticking out of the water, and the bulk of the iceberg is hidden under the surface. Kuhn said scientific paradigms were like this, so that the stuff one learns from text books or scientific journals, the explicit words and specialized languages of the various sciences, are the tip of the iceberg. However, for each explicit word used in a science, there were many implicit assumptions underlying the meaning of these words. These formed the hidden underside of the paradigm, like the submerged bulk of an iceberg.

This hidden underside is in large measure conditioned by non-scientific things, like people's individual prejudices and experience, and the belief systems imposed on scientists by their culture. That is to say, subjective things factor importantly into our supposedly objective understanding of the world. The short of Kuhn's view of science is that science is a mental and social network, with many different types of nodes. Some of these nodes are easily identifiable as the accoutrements of science, but most of them are not but instead are normal social and psychological factors.

The tentative consensus to emerge from post-positivist thought is that science is "**inter-subjective verifiability**." This view acknowledges that we are subjective beings, but states that we can find common ground to agree on things such as how to perform and interpret the results of experimental measurements or mathematical procedures. This common ground is what is meant by the term "objective". However, this does not solve the demarcation problem, because it can apply to any human activity where everybody agrees to do things a certain way, for example, in mathematics or computer science and in most forms of art, such as Classical Western music.

From this very brief description, you can see that the "demarcation problem" seems to start out easy. But when we think about it more deeply, it becomes more ambiguous, and it becomes more difficult to clearly demarcate science from other human activities. So, at present, there is no answer to the "demarcation problem". There is no agreed on understanding of what science is that distinguishes it from other activities like art, or technology, or even politics and religion! Intuitively, most everyone will agree that science is different from art or technology, politics or religion. But pinning this down and expressing it intellectually, to everybody's satisfaction, has proven impossible to the present time.

As usual, the modern Western intellect ends in confusion.

In Part 2, we introduce yogic ideas and see if they can help us understand what science is.

PART 2: HANGING IN THE MIDDLE

inside out
outside in
every day

Summary: Part 2 closes out the discussion of the demarcation problem, and introduces additional ingredients of the discussion: the subjective/objective dichotomy, yoga, and samadhi.

DEFENDERS OF SCIENCE ARE NOT OBJECTIVE

Part 1 ended on the realization that no one has successfully defined what science is. If one goes on the physics blogs (like **here** and **here**) you can see the philosophy that is adopted is that of **Karl Popper**, who defined science as the attempt to prove ideas were not correct. This is called **falsification**. It is a common sense view with merits. However, Popper's idea came before the Kuhnian revolution mentioned in **Part 1** and therefore Popper's view of science is incomplete. Since Kuhn, things got very messy in

philosophy of science. For example, the philosopher **Paul Feyerabend** came to the conclusion that there was no single rational way to define science.

Most scientists aware of the newest ideas in philosophy of science tend to reject them, not because they are bad ideas, but because they are emotionally disturbing and cause discomfort to practicing scientists by implying that science is not fundamentally different from other human activities, most notably religion.

There is also the issue of "**pseudo-science**", or fake science. There are many self-appointed "keepers of the faith" in science who try to defend science from crackpots and fakes (**like this guy for example**). All of this rests on very shaky grounds because, as stated, there is no agreed upon definition of what science even is. So, it has become a very subjective and opinionated enterprise for those who defend and define science, and those who seek to protect science from "pseudo science".

At the core of the issue is the seemingly obvious aspect of science that it discovers the nature of the objective world, that it discovers how things work, independent of human biases, influences and subjectivity. Thus, what is subjective and what is objective sit at the heart of trying to define and defend science. It is via the subjective/objective dichotomy that we bring the ideas of yoga into the mix.

SUBJECTIVE AND OBJECTIVE

In ***The Study and Practice of Yoga Volume* 1** by **Swami Krishnananda**, he presents this relevant observation:

> "Consciousness wrongly and foolishly imagines that it has no substantiality inside – that substantiality is only in the object outside…It wants to import the being of the object into itself .. which is a mix-up of perceptional experience … and the…character of the object upon consciousness. We are left hanging in the middle – with a part of objectivity and a part of subjectivity in us. …."

What is the great Swami saying here? He is saying we perceive things that appear to be outside of our mind, notably the world we live in, and attribute to it substantiality: the world is solid, real, it exists. But at the same time,

we do not consider our thoughts and emotions, subjectivity in general, as real, solid things. These instead are thought of as ghosts, as ephemera, as somehow less real than the world. This, he is saying, is ass backwards. The fact is: the world we perceive occurs only inside of our mind. Therefore it is the seemingly subjective that is solid and real, and the seemingly objective world we perceive is what is really ephemeral. To anyone who knows **yogic and Hindu thought**, this is a standard and unsurprising view. And it is our point of departure for bringing yogic thought into the discussion.

As is a repeating theme on **PlaneTalk**, it is clear that we "point" in both subjective and objective directions at the same time. One can see the history of Western philosophy as trying to take one of these sides and say it causes the other side. Thus, **materialism** claims that mind is somehow caused by material factors. **Idealism**, on the other hand, tries to explain matter as being caused by mind.

We can see above that the materialism/idealism debate is reflected in the demarcation problem. Classical philosophy of science saw the scientific enterprise as 100% objective, but as people thought more about it, subjective factors were also recognized to have a role.

As Krishnananda indicates, objective and subjective are both true on their own terms. In Western philosophy, this position is called "**dualism**" where both sides of the coin are acknowledged. I won't discuss the variety of ideas of dualism in Western philosophy. While they have merits, they simply are not as good as the yogic ideas. Therefore, we will consider the yogic teachings.

SAMADHI

Yoga teaches techniques to make the mind "one pointed"; it teaches how to concentrate the mind, literally. Lay-people understand this as "meditation". But yoga is a complex technical discipline, very much like the various sciences, and it cannot be understood in a simple or superficial fashion. Here is not the place to go into the depths of yoga (you can find resources **here** and **here** and **here**). Instead, I discuss the state of consciousness achieved in yoga called samadhi and the bearing this has on the question "what is science?"

Samadhi is the state of maximum concentration of the mind. To understand this, first consider your mind in your normal everyday life. You think about all kinds of things. Your attention constantly shifts as you involve yourself with different activities. You have different goals throughout the day. Even as you go about your daily activities, you find yourself thinking of other things: maybe anticipating the next thing you will be doing after the current activity; maybe you daydream; maybe memories pop into your mind. All the while, you are feeling different emotions, depending on what is going on around you, and on your goals and anticipations. Your mind is in a constant state of ever-shifting activity. In yoga, this state is called "**vikshepa**", which means "distracted".

To picture the vikshepa state, imagine your mind is like a big fluffy cloud, all puffed up and spread out. Now, imagine concentrating this cloud down, making it progressively smaller, more dense, not puffy and spread out. This is what practicing yoga does to the mind. The mind becomes focused on only one thought, and it holds this thought, and doesn't wander at all from thought to thought. When the technique of holding a single thought is perfected, this is the state of samadhi.

A bizarre effect results from so concentrating the mind: the person holding the thought and the thought itself fuse into one thing. The observer and the observed become one unified mental activity. We cannot understand this effect because it never occurs in our normal waking state. Almost by definition, being awake in the world is a state of vikshepa. Samadhi is an **altered state of consciousness**. The fusion occurs only when the mind is highly concentrated, not when it is diffuse or vikshepa.

The key point about samadhi is that it is the one mental state humans can achieve where the dichotomy of subjective and objective breaks down. In this regard, samadhi is analogous to black holes, where space-time breaks down. Both are singularity states. While black holes are physical phenomena in the seemingly external world, samadhi is an actual form of human experience. The relationship of the observer and the observed in samadhi has much to teach us about what science is, which will be elaborated in subsequent parts of this essay.

Here we close out on the following. If one has never heard of samadhi before, or is completely unfamiliar with the methods of yoga, then hearing these things for the first time sound utterly fantastic and unbelievable. In a similar vein, hearing about the Large Hadron Collider, or the Hubble

Telescope, or genetic engineer is also quite fantastic to those not initiated in how such things are done. Like any specialized technical knowledge, you either know it or you do not. Please never forget the key theme of PlaneTalk is altered states of consciousness. I have written **simple methods for beginners** to take their consciousness into the other realms. More sophisticated writings are available for those who wish to learn more about yoga and its techniques (**here**, **here**, **here**). This essay is not intended to teach yoga. It assumes the reader has some basic familiarity with these things because here we are interested in the bearing of the yogic methods for understanding science.

Having said the above, we close out Part 2 with the punch line of this whole essay: **science is a very weak form of samadhi**.

Fear not, we still have 8 parts of the essay left to go to fill in what this means…

PART 3: WE CAN BE HEROES

Summary: Part 3 brings a critical element into the discussion: that accurate knowledge leads to the ability to manipulate the world. This is true of both science and yoga.

KNOWLEDGE IS POWER

What is the tangible result of successful science? Certainly a more accurate understanding of the world would be most people's first answer to this question. In addition, it is generally agreed that successful science should allow prediction of new phenomena that were not previously known.

It is a great irony that scientists who so pride themselves on their realism and objectivity, consider as their greatest prize mere ideas. But aren't thoughts and ideas merely subjective artifacts of the mind? Well, no, obviously, not at all. Within the scope of this article, the most important tangible result of successful science is that it is always accompanied by the ability to rationally cause changes in the world. Generally, this is classed as "technology" and considered separate from science. But the distinction is

arbitrary. Technology follows from science like theorems follow from axioms; they are indelibly interrelated.

The Mars Rover or Hubble Space Telescope are products of Newton's and Einstein's gravity, of Maxwell's electromagnetism, and quantum electrodynamics. They cannot be thought of separate from the science. In many instances, new technology is only about the science, as with the Large Hadron Collider, or DNA microarrays, or the atomic force microscope. These technologies are used mostly in the lab setting to further the science (although microarrays are gaining traction in medical applications, and AFM has industrial applications).

So, distinguishing science from technology is a relatively arbitrary distinction. The distinction mostly follows the necessity for division of labor. It takes a lot of time to do basic science, so other people must extend the scientific ideas to generate technology. These other people are called "engineers" and not thought of as scientists. Distinguishing science from technology is more a social and economic distinction than an intellectually deep difference.

Bringing the technological aspect of science into the mix is relevant to the demarcation problem. Science lets us change the world. However, it cannot just be about changing the world in new or predictable ways for this also applies to art. A new painting, song, or novel is also a physical change in the physical world, and it was generated by the artist using the methods of their craft to output a predictable result. Hollywood uses the same tired formula for scripting its banal movies, for example. Yet, there is some intuition that the products of technology are different from the products of art. But are they?

At this point in the discussion, we are not in the position to offer an answer as to whether science and its technology are different from art. Our purpose now is to introduce a key idea into the discussion that science is accompanied by the ability to manipulate the world. The short way to say this is: **knowledge is power**.

Perhaps the most graphic image of "mere" ideas releasing power is the mushroom cloud of the atomic bomb, a physical manifestation of Einstein's $E = mc^2$. Where does this power come from? Why do some ideas allow the release of such power but other ideas do not? Yoga has something to say about this, something much different than the conventional Western ideas.

SUPERPOWERS

Part 2 introduced the idea of samadhi: the extreme concentration of the mind that causes the observer and observed to fuse into one entity in consciousness. When this happens, not surprisingly, it has effects. Here we introduce the effects, which are called "siddhis".

When the observer fuses with the observed in samadhi, the consciousness of the observer melds, or becomes one with, the consciousness of the object. How we may consider the object of meditation to have consciousness, and further, how this consciousness is accessible to the yogi, are discussed in later parts of this essay, but not here. For the moment, the Reader is asked to accept that these are the terms used in yoga to describe the process. In this act of fusing, the observer and the observed become one entity. The intimate details of each are now accessible to the other. The consciousness of the yogi fills with the consciousness of the object and vice versa. The siddhis follow as a consequence of this fusion.

Yogic descriptions of the siddhis seem very bizarre and unrealistic on first hearing. Siddhis are the "super powers" one gets as a side effect of fusing with the object of meditation. I state here, but do not elaborate until later, that siddhis are merely a side-effect and not at all the intended result of practicing yoga. Siddhis are actually discarded and downplayed in yoga. But the fact that siddhis result from samadhi has great bearing on the question of how accurate scientific knowledge allows the release of power in the universe.

Let's list a few siddhis from the above Wikipedia link:

[1] AṆIMĀ: reducing one's body even to the size of an atom
[2] PRĀPTI: having unrestricted access to all places
[3] TRI-KĀLA-JÑATVAM: knowing the past, present and future
[4] DŪRA-ŚRAVAṆA: Hearing things far away
[5] DŪRA-DARŚANAM: Seeing things far away

These siddhis result from taking as the object of mediation: space ([1] and [2]), time ([3]), the ear and sound ([4]), the eye and light ([5]). So, by concentrating one's mind to the extreme, and fusing with the idea held in the mind, one can potentially shrink to the size of an atom, go anywhere in the universe, know the past, present and future, and see and hear things far away. Other siddhis can be obtained by performing samadhi on other objects of meditation. The lists of the siddhis reads like comic book

superheroes: Superman's ability to fly, Spider-man's spider senses, or Doctor Strange's ability to travel in his astral body.

The above list is misleading however by suggesting the siddhis are physical events. For example, the description of aṇimā seems to indicate one shrinks their physical body. This is not so. The siddhis occur in the mind. One shrinks in their mind so as to be able to perceive things the size of atoms. All of the siddhis above occur in the mind and are not physical events. An historical example of aṇimā, the Occult Chemistry of Besant and Leadbeater, can be found here.

To a modern rational person, this all seems like total nonsense, like the imaginations of a crazy person. However, consider the following:

[1] AṆIMĀ: An atomic force microscope lets us see physical atoms.
[2] PRĀPTI: We can use electromagnetic radiation to see into the heart of our galaxy; use the cosmic microwave background to see the structure of the universe shortly after the Big Bang.
[3] TRI-KĀLA-JÑATVAM: One word here: differential equations.
[4] DŪRA-ŚRAVAṆA: Microphones, anyone?
[5] DŪRA-DARŚANAM: Spy satellites? Google Maps?

Think of it: by concentrating the mind, one can see atoms, go anywhere, know the past and future, and see and hear things at a distance. In the second list we see technologies that either extend our senses (microscopes, etc) or extend our mind (differential equations). We do not physically change ourselves, just as siddhis are not physical events. Although most technology is physical, the output or result of the technology is mental. However, math is different. No one would deny that math has literally changed the world. But math itself is not physical. Math is idea. We return to comparing math to samadhi in later parts of the essay.

Now, one may reasonably object that in the case of the 2nd list, this is all technology that has come about through long and laborious processes involving the efforts of countless people, much trial and error, and many blind alley ways, which eventually led to modern science and its application in engineering and technology.

If one takes this stance, then they are making my point for me.

PART 4: EVERYTHING'S ALL MIXED UP

Emulsions courtesy of Orbiting Frog

Summary: In Part 4, we roll up our sleeves and start getting technical and discuss the yogic theory of knowledge that underlies what occurs in samadhi.

KNOWLEDGE AND POWER…AGAIN

The crucial aspect shared in common between the claims of yogic samadhi, and the tangible results of science is that KNOWLEDGE EQUATES TO POWER. Knowledge is not a bunch of empty meanings, but **meanings that allow us to cause things to happen**. When knowledge, scientific or otherwise, does not allow us to cause things to happen, then, I would suggest, it is not science at all. It is poetry; more or less beautiful, perhaps, but poetry nonetheless.

When we consider the different views of science outlined in Part 1, they tend to treat the knowledge aspect of science, but do not give due weight

the power aspect. The demarcation problem involves not only the idea of objective knowledge. What the concept of "objective knowledge" implies is the ability to cause changes in nature, to exert power in nature. The power aspect is just as important as the knowledge aspect. Any attempt to define science that neglects the power aspect is incomplete. Whatever science is, it is as much power as it is knowledge.

Let us consider briefly the general process underlying the release of this power. Whether we consider the history of our understanding of gravity, heat, light, or biology, we see people concentrating their minds to understand. What causes the mind to become concentrated? A person's will is what concentrates the mind. Something drives and motivates a person to concentrate on a particular topic. Then, as is accounted in the philosophy of science, the discovery process begins. Discovery has been recognized to be haphazard and unpredictable. Through trial and error, the efforts of thousands of people over historical time slowly peel back the dross, the false understandings, associated with a given phenomenon, and reveal the truth. Accompanying the truth is the ability to manipulate reality, which is to say, power is released.

A very similar thing happens in samadhi, only to a much higher degree because the concentration involved is so much greater.

THE CORE OF THE SEED

To understand what happens in samadhi, we must introduce some of the technical vocabulary of yoga. Our word "truth" is synonymous with the Hindu word "svarupa". "Sva" means "within itself" or "self-contained". "Rupa" means "body" or "form". So, svarupa is the form of the truth of the thing within itself. More than a thousand years after Hindu's began using the term "svarupa", Kant presented the concept of "das Ding an sich", "the Thing as such", or the "thing in itself".

Kant's idea of the "thing in itself" and its attendant philosophical implications is the closest we in the West have come to the notion of svarupa. Svarupa is the perfect understanding of a phenomenon. Kant deduced this understanding was inaccessible to the human mind. He was only half right. Such understanding is inaccessible to the human mind when it is in a state of vikshepa. However, Kant did not know yoga. Part of what

happens in samadhi is the yogi becomes one with the svarupa of the object of mediation and comes to understand the thing in itself.

The other aspect of perfect knowledge obtained in samadhi is called "artha". Artha is the technical yogic term to describe the result of the fusion of the observer and the observed. Artha, as used in yoga, translates to the "real essence" of a phenomenon. Generally in Sanskrit, "artha" means "goal" or "means" (as in means to an end). Upon achieving samadhi on the object of meditation, it is said that the "artha", the "power" of the object is released within consciousness.

Sometimes artha is equated with the core of a seed. It is the core of the seed, and not the outer coatings, which contains the essence of the seed. The outer coating is just a protective, and often nutritive, layer to protect the important stuff, the essence, at the core of the seed. We now know the genetic material is in the core, and the genetic material indeed has power. It has the power to make a new plant when circumstances allow.

GOING DEEPER INTO YOGA

Part 3 introduced the intimate link between knowledge and power. Science manifests power through a combination of empirical and mental means. In yoga, it is found through purely mental means. By concentrating the mind to the extreme on the object of meditation, the fusion of observer and observed occurs, and accompanying this is release of artha and the revealing of the svarupa of the object of mediation.

The truly fantastic claim of yoga is that it is possible to discover the truth, the artha, of a phenomenon, by performing samadhi on it. The process involved is technical, complicated, and involves a level of effort unknown to people who do not practice yoga

Nonetheless, yoga is a systematic discipline and has an exact theory of how this process occurs. The main text book of yoga is Patanjali's *Yoga Sutras*. The process by which artha is released in samadhi is described in aphorisms 1.42 and 1.43. The following transliterations are from I.K. Taimni's *The Science of Yoga*, a commentary on the *Yoga Sutras*:

४२. तत्र शब्दार्थज्ञानविकल्पैः संकीर्णा सवितर्का ।

Tatra śabdārtha-jñāna-vikalpaiḥ saṃ-
kīrṇā savitarkā.

तत्र there; in it शब्द (with) word अर्थ real meaning; true knowledge of the object which the *Yogi* wants ज्ञान ordinary knowledge based on sense perceptions and reasoning विकल्पैः (and) alternation between different alternatives owing to doubt or uncertainty संकीर्णा mixed up; confused; unresolved; involved सवितर्का a state of *Samādhi* characterized by *Vitarka* (see I-17 and II-19).

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४३. स्मृतिपरिशुद्धौ स्वरूपशून्येवार्थमात्रनिर्भासा निर्वितर्का ।

Smṛti-pariśuddhau svarūpa-śūnyevārtha-
mātra-nirbhāsā nirvitarkā.

स्मृति (of) memory परिशुद्धौ on clarification स्वरूप own form; essential nature; self-awareness शून्य devoid (of) इव as if अर्थ-object; real meaning; true knowledge of the object मात्र- only निर्भासा presenting; shining (with); appearing (as) निर्वितर्का a state of *Samādhi* characterized by absence of *Vitarka*.

The translations are:

> "1.42: Savitarka Samadhi is that in which knowledge based only on words, real Knowledge, and ordinary knowledge based on sense perception or reasoning are present in a mixed state and the mind alternates between them."
>
> "1.43: On the clarification of memory, when the mind loses its essential nature (subjectivity), as it were, and the real knowledge of the object alone shines (through the mind) Nirvitarka Samadhi is attained."

Aphorism 1.42 contains the meat and potatoes of the process, whereas 1.43 explains the expected result of successful samadhi and will be discussed in Part 9. Here we discuss 1.42, which provides a theory of the nature of knowledge. It claims there are three types of knowledge that, under ordinary circumstances, are indelibly mixed in the human mind. These three types of knowledge are listed in 1.42 as (the quotes are definitions from Taimni):

Sabda – "…refers to knowledge which is based only on words and is not connected in any way with the object which is being considered". Sabda

means “sound” and refers to the arbitrary words and symbols we use to denote the objects of our experience.

Jnana – “…refers to the ordinary knowledge based on the perception of the sense-organs and the reasoning of the mind.” This is empirical knowledge.

Artha – “…refers to the true knowledge about the object or its real meaning which the Yogi wants.” This is Kant’s “thing in itself”, and, as you see, is described by the word that translates as “power”: artha.

Let’s quote Taimni a little more because his description is perfectly lucid:

> “The condition of not being able to distinguish clearly between these three kinds of knowledge with the result that the mind hovers between them is sought to be conveyed by the word Vikalpaih. This is inevitable as long as the three kinds of knowledge have not separated out, as it were, in three separate layers but are present in a state of mixture or con-fusion which is indicated by the word Samkirna. It will perhaps help the student to understand this progressive resolution of the three kinds of knowledge if we illustrate the process diagrammatically as follows:”

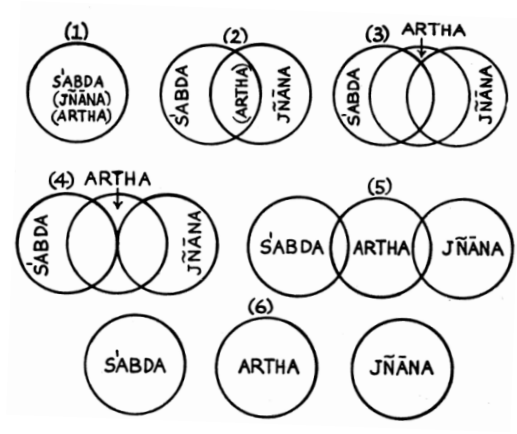


Figure 6 from Taimni’s *The Science of Yoga*.

He explains this diagram as follows:

> “It will be seen that while in the first step knowledge based on Sabda only covers the other two, the progressive resolution results in the last step in the complete separation

> of the three. Students of Science will also find the analogy of an emulsion helpful in understanding this progressive resolution and separation into two separate and distinct constituents. If two immiscible liquids are shaken together vigorously it is possible to prepare an emulsion in which both appear to be present in a homogeneous condition though they really remain separate. But if the emulsion is allowed to stand for some time the two liquids will gradually separate out into two separate layers. This analogy is especially apt because it is the absence of agitation which leads to the separation of the two layers just as in Savitarka Samadhi it is really the extreme tranquillization of the mind which brings about the separation of the different kinds of knowledge."

An important idea is in play here that has not yet been explicitly stated about yoga. Meditation involves relaxing the mind to an extreme degree. This is explained in detail in Part 6. Here we only briefly introduce the concepts. In the West, meditation is associated with a casual type of relaxation, but real yoga consists in the complex technical discipline to train the mind to not move at all. The very definition of yoga is: "**yogah chitta vritti nirodhah**". This means "yoga is the silencing of the modifications of the mind".

Therefore, as Taimni rightly points out, this extreme state of mental stillness results in the object of mediation undergoing a process that is analogous to the separation of an emulsion into its constituent immiscible parts.

YOGIC KNOWLEDGE THEORY AND SCIENCE

While there are many theories of knowledge, the yogic theory described above is **operational**. Scientists of all stripes should be able to appreciate the value of operational ideas. The above concepts derive from the experience of yogis in altered states of consciousness. It is therefore not merely an intellectual exercise, but is the information required to understand and comprehend what advanced yogis experience in meditative states.

The knowledge and ideas in our normal waking mind, what Taimni calls

vikalpa, underlies the distracted state of vikshepa. In our everyday life, we see the world in this confused, compound state where sabda, jnana and artha are mixed up in what appears to be a homogeneous state of mentation. In the West, we do not even realize that our mental states have this form.

Understanding the three tiered yogic theory of knowledge helps us better understand what science is trying to accomplish. Science is about separating sabda from jnana. This is why the (good) scientists are so adamant to eliminate the observer and subjectivity from the picture. The arbitrary subjectivity is sabda; words, symbols and concepts we use to describe things that do not have any substantial link to the thing itself.

For example, we see the Sun in the sky. The Sun is really there, it is really an objective event in our perception. But then there are all kinds of surrounding ideas related to us and not to the Sun itself. We call it "Sun", which is our word, not its real name. Past cultures had all kinds of myths about the Sun God. These are all words and sounds, sabda, unrelated to the Sun as a thing in itself. Science tries to separate out the sabda aspect and this is why science wants to eliminate the observer from its descriptions of nature. It is trying to isolate the essence of the phenomenon, independent of all the subjective aspects included in sabda.

However, it is not even that sabda means subjective. The sabda components of knowledge are arbitrary and do not relate to the perceived object. Science is confused by not clearly distinguishing "arbitrary" from "subjective". Again, all awareness occurs in the mind, so all awareness is, in this sense, subjective. It's just that some subjectivity is better than other subjectivity.

In addition, there is further confusion in science because the West in general does not distinguish jnana from artha. We feel the Sun's heat and see its light, its size, its distance from us. Color, heat, shape, distance, etc. are consequences of our nervous system; are the means by which our nervous system distinguishes the Sun from other objects of perception. Does color and heat as we experience it exist outside of our minds? Is the Sun really yellow-orange or is that just how our mind pieces together the actions of the nervous system? Certainly the Sun gives off radiation, the frequencies of which our nervous system codes as color. The radiation has force, which our nervous system codes as heat and

warmth. But when we feel warmth from the Sun, or see its yellow color, this is a product of our nervous system.

The level of understanding of empirical and relational characteristics is jnana. From a science perspective, what we call the "Sun" is the bundle of our sensory perceptions and associated ideas that give meaning to those sensory perceptions. Science operates at the level of jnana because it is primarily concerned with the empirical. Empirical is that which is presented to the mind by the senses.

Do scientists try to understand the deep essence of the Sun? In a way they do, but the efforts are not thought of as such. We understand the Sun within the framework of other observed stars. Via the theory of nuclear reactions, we know something about what occurs in the Sun's interior, about events that are outside of our sensory experience altogether. We understand nuclear chemistry and mimic it here on the Earth, and certainly, as pointed out elsewhere, artha, power, is released. But these efforts are only superficially systematic. They are, in fact, simply guided by induction because there is no operational framework in any of the Western sciences that clearly separates jnana from artha. Hence, things like the collapse of the wave packet cause endless confusion.

There are much deeper aspects to artha. If science was interested in knowing the artha of the Sun, it would know the Sun's real name. It would understand the Sun, not as a statistical example of one sun among a myriad of stars, not as a sensory entity at all. It would understand the Sun as the unique being it is in the overall scheme of things. It would know the spirit of the Sun. Such understanding is implied in the artha of the any object, a concept we elaborate in future parts of this essay.

WRAP UP

To wrap up for now, the yogic theory of knowledge gives us three categories of understanding:

Sabda is the purely arbitrary aspect of language and symbols, where the symbols used to designate a phenomenon have nothing at all to do with the essential nature (the artha) of the phenomenon. This is the realm of post-modern analysis of linguistics. There is value in discerning hidden implications in words, and this level of understanding is a critical aspect of

yogic practice. But, in the final analysis, the level of sabda must be discarded to get at true, deep understanding. But one cannot get to the jnana and artha levels in any real depth without first sublimating the sabda level, and its potential hidden meanings of emotion and egoism.

[In passing I note that there is a means to link the sabda level directly to the artha level. This is called Nada Yoga, and our modern sciences are already moving along this path of discovery – but elaborating this is a topic for a future project.]

Jnana is that understanding that comes from the senses and from the understanding in the mind based on what the senses present to it. This level is confusing in Western science because there is no systematic understanding of how the sense and the mind, as middle men, condition the things perceived. What is perceived in the mind has a very specific appearance in the mind, not only because of the nature of the object, but also because of the nature of our biological, emotional, psychological, and yes, spiritual, constitution. The Sun is not yellow-orange except in our minds. Nor is sun-light warm, except in our minds. Science is mostly caught up at the level of jnana. This is so because, first, science is self-defined as being empirical, as relying on the input of the senses in arbitrating understanding. Second, Western sciences ignored Kant and never bothered to systematically tackle the issue of the World as a thing in itself verses how the World is presented to the human mind.

Artha is the true essence of a thing. In general, science does not distinguish jnana from artha. Science haphazardly, in a few instances, has stumbled into aspects of the artha of some of the facets of nature. These haphazard discoveries, mainly in physics and chemistry, but recently in biology as well, have completely transformed the world by the tremendous release of power they have engendered. But because the discoveries have been haphazard, they are incomplete and lack the true perspective in which ideas such as relativity, quantum mechanics, information theory, etc belong.

However, in yoga, distinguishing jnana from artha is an operational necessity. It is the direct experience of yogis that what is all mixed up in the mind of a normal person precipitates out into the constituent phases in meditation. Samadhi directly reveals artha.

Above we outlined the “how” of this process. As we progress in the essay, we will discuss how it is possible that ideas in the mind of the yogi are not only comparable to sensory perceptions, but superior to them.

PART 5: THE WHEELS OF THE BUS GO ROUND AND ROUND…

Summary: Here we review and revise the history of science to recognize that yoga is one of the great scientific accomplishments of mankind.

We have now introduced most of the main ingredients of the story: the failure of the demarcation problem, the objectivity/subjectivity dualism, science as knowledge AND power, samadhi, siddhis, and the three layers of knowledge. We are almost ready to dive headlong into discussing the difference between power released via sensory experience verses power released in samadhi. To set the stage for this task, Part 5 digresses on some history. Here we review, and revise, the history of science.

HISTORY REPEATS ITSELF

Materialism is the intellectual position that the mind is caused by material factors; the brain, senses, etc. This view rose a generation or so before Newton, in the musing of Descartes. Descartes was not a materialist, but

his thinking dichotomized existence into the mind on one hand, and the world, or matter, on the other hand. It is worth reminding the reader that both Descartes and Newton are founders of our modern Western science.

During the time of Newton, a pesky Irishman, who must have felt a kinship with Zeno of Elea, offered the opposite interpretation of things and stuff. George Berkeley gave us idealism. The main fact of idealism is that all understanding occurs within the mind. The implication of idealism is that the world we perceive with our senses is in some very deep sense secondary to the mind itself. The two positions have fought over the ensuing centuries, sometimes one, sometimes the other, gaining the upper hand.

An abbreviated history goes something as follows. Kant destroyed materialism and made idealism forever inaccessible. Given that the former was impossible but the later was only forever inaccessible gave idealism the upper hand to flourish until around 1900 (British idealism, anyone?). But in those 100 years after Kant, something happened to tip the scales of war: science became very successful. It generated the industrial revolution in the West. In other words, much power, much artha was released by science. Basking in the afterglow of 19th century science, logical positivism became the new materialism around 1900, with perhaps Bertrand Russell as its major cheerleader. But the glory was short lived. A bevy of onslaughts ensured its rapid demise: Gödel in mathematics, quantum mechanics and relativity in science, Wittgenstein in philosophy, Dali in art.

After about the 1930s, the world became a topsy-turvy post-modern simulacrum of the world where matter is energy, mathematical deduction proves uncertainty, men become women, and kids dictate what adults do. This is the intellectual world we live in today. One word can describe it fairly comprehensively: unanchored.

The meaning of being unanchored was explained well by J. J. van der Leeuw:

> "If we rush into activity, without having this realization of philosophy, we are as a man who undertakes a long journey without first acquainting himself with the nature of the country through which he must travel and the road he must follow. If we were to offer such a man the help of our experience by explaining to him a map of the country through which he has to find his way, and if he disdained such help, saying that it was not practical, that only in doing the thing, practical reality could be found, we should surely

look upon such an one as foolish. In a similar way, if a man were to voyage across the ocean and disdained to learn the principles of navigation and the use of the compass, saying that all such theory was but superfluous and unpractical and that the right thing to do was to set out and undertake the voyage, we should again consider such an one as unpractical and lacking in wisdom. Yet in our daily lives we do disdain the knowledge of the country through which we must all travel, we do disdain the map which philosophy can show us and we have no time to learn the navigation of life."

IT'S ALL IN YOUR MIND

Ironically, the drama, the intellectual history of the West, has played out in a world that is inside of people's minds. It is the height of ignorance to not recognize the central tenet of idealism that all we know is inside the mind. All perception, all thought, all emotion, occur within the mind. All ideas of what we are and what the world is occur within the mind.

Nonetheless, the world presents itself with an overwhelming forcefulness. We see, hear, feel, and taste the world. We have a body in this world. It is incontrovertible that our bodies exert a tremendous influence over our minds. It is also the fact that we cannot just magically think a thing and it becomes so. The world itself offers a very solid and real resistance to our thoughts. It is this resistance of the world to our thoughts that is the basis of the materialistic position. It is not an unreasonable position at all. But it is not a deep position either. Materialism, and its current incarnation as physicalism, is the stance of a brute who does not wonder too deeply about the relationship between the world, body, and mind. Materialism is a philosophical map of sorts, something akin to a kindergarten child's crayon drawing of a tree.

Materialism

As it is a fact that we cannot just think any arbitrary thought and bend the world to our will, it is also a fact that we can think very specific, very technical thoughts and bend the world to our will. It is the inability to explain these facts that makes materialism so impotent. But by neglecting matter, by relegating it to a second hand status, idealism doesn't offer help answering this question either.

MEANWHILE IN A UNIVERSE FAR, FAR AWAY, LONG, LONG AGO…

In a wonderful talk about Patanjali's Yoga, Jay Lakhani of the Hindu Academy makes what I feel is an absolutely critical point about yoga that is not generally appreciated in the West. He points out that the Hindus were smart enough to first question the nature of the human mind before trying to describe the objects of perception. While there are echoes of a materialism/idealism debate in Indian philosophy, this debate never amplified to the toxic extent it did in Western history. Instead, India went in a completely different direction. Jay explains this in his talk specifically here. I will quote a few important bits from his talk:

> 'In ancient times human beings throughout the world were trying to make sense of the human condition: 'who are we?', 'what are we doing here', 'what is the nature of reality?', 'who am I?', 'what is going on here?' … this is how the story began.
>
> Now you see, somehow we were forced to live in India, and because of the weather conditions or whatever, that the journey went inwards. He says, 'Before I make sense of the world external, what is the nature of this reality, let me first suss out what tools I possess. What is my ability to make sense of this world? What are the tools I possess? What is my own credential?' So the journey went inward.
>
> And this is important …unless you know what is your own capacity, the answer you're going to get regarding nature of reality, it's not really put into the right perspective. What is your capacity to understand the nature of reality? You must first of all suss out, look at your tools and say 'yes, I possess such powerful tools, I can find a resolution to the human

> condition'. So you must look at your own tools…this is what we did, we went inward and said 'what is our own nature?' This is where we hit the jackpot. "

Indeed, they hit the jackpot. As Mr. Lakhani explains Kapila discovered yoga. Even the history buff and Indophile I am, I had never heard of Kapila before hearing this talk.

This story of how yoga arose in India is not at all a part of the Western version of the history of science. The story of the history of science in the West begins with Newton, with some hat tipping to the ancient Greeks. India's contributions are relegated to mere footnotes. Nowhere in this story is found the towering achievements of Kapila, Patanjali, Abhinavagupta, or the many other contributors to the science of yoga over the millennia. Western science simply does not know about, let alone acknowledge, the techniques and methods they invented to "go inwards" to "suss out the tools we possess…to make sense of this world".

Certainly Western philosophy has its share of trying to suss out the tools we humans possess to understand the world. It is called epistemology, the branch of philosophy about the nature of knowledge and about our mental attributes. The various forms of psychology that disguise themselves as science have, here and there, glimmers of insight, much as occasionally a shiny rock is found amongst the dull rocks at the beach. But our Western psychologies are of the nature of skipping a rock over the water, and none of them have the faintest idea of the depths upon which they skip. At this point in the discussion, we have established that true science releases power. By this criterion, Western psychologies are less than firecrackers.

There is a quantum difference between Western and Hindu understanding of the mind. This is an untold story in the history of science because we in the West are ignorant of what yoga entails. Yoga is not merely intellectual; it is not just words and philosophy. Yoga is a set of techniques and methods for directly studying the nature of the mind and consciousness. The understanding in the West is that of the armchair philosopher: it is mere ideas and arguments, endless words. Yoga is activity: it is understanding based on method and experience. In this, science and yoga are the same. Both have left a trail of highly technical methods, recipes, procedures and protocols that, when followed, release power in the world.

So, what is the purpose of this brief history lesson? It is to recognize yoga as one of the great scientific achievements of mankind. Yoga is neither religion

nor philosophy. The closest we can come in our Western experience to understand yoga is to recognize it as most like what we call “science”. However, the general knowledge of yoga in the West is that of Hatha yoga, the yoga of how to position the body. This is only a very small subset of what yoga is. Again, Mr. Lakhani discusses the place of Hatha yoga in the scope of all the yogic disciplines, and it is hoped the interested reader will take the time to watch his wonderful talk.

Religion as practiced in the West is mere belief. It is only sabda: sounds, words, myths, beliefs. Philosophy is an echo of sensory experience, a reflection on experience. So, philosophy is not just sabda, but has some bit of jnana. But then, the echoes compound one upon another into a cacophony of chaos. Because of this, Western philosophy by itself does not release power, other than perhaps the titillation accompanying airy abstractions, or perhaps the occasional political revolution (that invariably never is what it was supposed to be).

But then there is science. Weird little symbols with very specific meanings, and highly ordered sequences of thoughts and actions that translate into to the release of power. Knowledge sculpted and disciplined by the regularity of our sensory apparatus. Yoga is like science, but much, much deeper, because it is not limited to the realm of sensory experience, but encompasses the totality of mind and consciousness. The totality of mind and consciousness is the domain of yoga.

Science put the cart before the horse trying to understand the world before understanding the mind.

Yoga has the horse pulling the cart by having first understood the mind.

Then the world fell into its rightful place.

PART 6: THE METHODS OF YOGA

Summary: In Part 6 we discuss the methods of yoga. In any science it is crucial to be able to evaluate the methods. The methods produce the result. The result cannot be understood without understanding the methods. Thus, it behooves us to consider, at least in broad outline, the methods of yoga.

As stated previously, yoga is defined by the phrase: "yoga chitta vritti nirodhah". This translates to "yoga is the silencing of the modifications of the mind". However, just because we can translate Aphorism 1.2 of the Yoga Sutras does not mean we understand it. Behind this simple phrase is a whole theory of the mind and human constitution. Perhaps an analogy is suitable. At my work, I might say this: "The polysome isolation must be very clean to ensure our proteomics is as accurate as possible". Yes, this statement too is in English, but it has a bunch of technical words. It takes people about 20 years of schooling and at least a year of lab experience to fully understand this sentence.

Therefore, what I will attempt here is to both outline the methods and the underlying theory of yoga so as to make the methodology of yoga as transparent as can be done in the form of an intellectual exercise. One cannot fully understand laboratory science until one goes in the lab and does it, even though I can explain clearly what and why I do specific things in the lab. Similarly, even though one can explain intellectually about yoga theory and methods, these do not come to life until one actually tries to do them. Here are links for simple exercises beginners can do for those interested to give it a try (1, 2, 3, 4, 5, 6, and of course my own methods: see chapter 2, pg. 62 in particular). However, I emphasize that the following is a high level discussion of advanced techniques, many of which are well beyond my skill level. However, because I have some experience with elementary techniques, I have at least an intuition of how the more advanced techniques play out.

OVERVIEW

When learning yoga, it cannot be emphasized too strongly how it must always be kept in mind that:

Yoga chitta vritti nirodhah

We already introduced the idea of vikshepa, distraction, whereby the mind is in a constant state of motion and activity. The prerequisite to perform samadhi is to cause this activity to cease. This activity is thought of as analogous to waves in the water, to whirlpools and eddies; this is what the word "vritti" means. "Chitta" means "mind", and "nirodhah" means "to minimize" or "to make quiescent". To effectively silence the "whirlpools" of the mind, there must be operational definitions of what the mind is, how it works, and how these processes can be made quiescent.

The basic idea is that of flow. There are sources that generate flows in the mind. If you can stop the sources of the flow, you can stop the motions in the mind. That is the general theory of how yoga works.

THE METHODS OF YOGA FORM A SEQUENCE

The theory described in Patanjali's *Yoga Sutras* describes different sources of input that feed content into the mind. Each source requires specific methods to tame or silence that source. The sources and the accompanying

method(s) to tame that aspect of the mind's contents are:

[1] The personality and its desires are tamed by practicing yama and niyama.
[2] The skeletal-muscular system is tamed by practicing hatha yoga techniques called asanas.
[3] The autonomic nervous system is tamed by practicing pranayama techniques.
[4] The special senses (seeing, hearing, touch, taste and smell) are tamed by practicing pratyahara (again, pg. 62 of DO_OBE; some good advice here).
[5] Memories are tamed by practicing samyama, the culmination of which is samadhi.

When we consider this list of inputs into the mind, it pretty much covers almost everything: the personality and its desires, the sensations from the physical body, both in its skeletal muscular and autonomic components, the senses, and the memories in the mind. When you subtract these inputs from a human mind, what is left?

In short, what is left is a disembodied consciousness. Awareness still remains, but awareness of what? This is the purpose of the object of meditation, technically called the **pratyaya**. Before explaining this, let's put what has been said above in perspective.

Again, we need to go to school for a long time to be a scientist. One must know how to read and write and do basic math. These very rudimentary skills are at the analogous level of yama and niyama. Yama and niyama consist of a set of prescriptions for behavior. Sometimes they are called the "do's and the don'ts", where niyama is the "do's" and yama is the "don'ts". Kind of like the 10 Commandments in Christianity, except there is an explicit logic and rationale for each of the yamas and niyamas. We don't need to go into the specifics here but can just discuss in general what these are doing.

SILENCING EXTERNAL INPUTS

If the purpose of yoga is to calm movement in the mind, then it goes against this purpose to intentionally cause motion in one's mind. This is the essence of desire and attachment, the main elements generating flow in the

personality. Yama and niyama are designed to teach the would-be-yogi to quit intentionally causing movement and flow in his or her mind. When one likes or hates anything, or desires or is repelled by anything, these are movements in the mind, these are vrittis. So, the absolute prerequisite to any of the more advanced practices in yoga are to quit intentionally causing these movements.

Yama and niyama do not work by prohibition. The 10 Commandments are supposed to work because, if you don't follow them, you will go to Hell. This is NOT how yama and niyama work. Yama and niyama sublimate the desires for worldly attachments into the desire to be successful in yoga. There is a whole complex rationale here that I am not going into. All I can say is that as many books and pages have been written about this aspect of yoga as there are books and journals about science. It is a very, very involved aspect of yoga. No success is possible in yoga unless yama and niyama can be mastered, just as no success is possible in science if one cannot read, write or do arithmetic.

To move forward with the discussion, let us assume the would-be-yogi makes progress on this front and can then move on to more advanced stages. The advanced stages can be broken into two parts: (1) silencing the movements of the mind caused by the body, and (2) silencing the movements of the mind caused by the mind itself.

Asanas (postures), pranayama, and pratyahara have one overriding goal: to silence the inputs from the body. In this regard, yoga offers its own science of physiology (a part of the Hindu philosophy of Tantra) by which to understand the body and how to silence it. So, we see here the purpose of hatha yoga in the overall context of yogic methods: asanas/postures are intended to eliminate from awareness the sensations of the skeletal motor system. Hatha yoga has nothing to do with exercise at all, and its role as such is a 20th century invention.

I will say only a few words about pranayama techniques. Pranayama gets very deep and implies a whole theory of a substance called pranā (see here too). But for the beginner, pranayama is designed to eliminate mainly the sensation of breathing from awareness. The sensations associated with breathing are a constant rhythmic activity of the body and therefore are a constant vritti in the mind. But, on one hand, even in normal everyday life, we lose consciousness of breathing until, for whatever reason, we pay attention to it. On the other hand, in yoga, where the mind seeks to be in a

quiescent state, this rhythmic activity has the potential to completely disrupt more advanced techniques. So, when one studies and practices pranayama techniques, one finds that they lead to a form of breathing that is so slow and shallow as to make this rhythmic activity almost imperceptible.

Pratyahara is perhaps the most mysterious of the body-oriented techniques. But, it is not that mysterious when properly understood. The brain very naturally shuts off awareness of the sensory world every night when we sleep. The main difference between sleep and pratyahara is that pratyahara is voluntarily induced, and that the yogi does not go to sleep, but remains lucid and aware after voluntarily shutting off the senses. Pratyahara has many parallels with lucid dreaming. Both are methods to shut off the senses, and both allow the mind to retain self-awareness and lucidity when the senses are shut off. The big difference between the two is that the lucid dreamer who explores the inner world of dreams is still in a state of vikshepa, only in the next plane, or loka, over from the physical plane. The yogi in this state is absorbed in the pratyaya and does not allow dreaming to intrude into his or her awareness.

So, to recap to this point: yama and niyama shut off the intentional movements of the mind induced by desires of an attractive or repulsive character, and asanas, pranayama and pratyahara shut off all of the inputs from the body. Taken together, these are called “bahiranga”, or external, meaning these are all inputs into the mind that come from sources outside of the mind itself. This leaves only disturbances caused inside the mind. The methods to quiet internal disturbances are called “antaranga” because they all occur only inside the mind of the yogi.

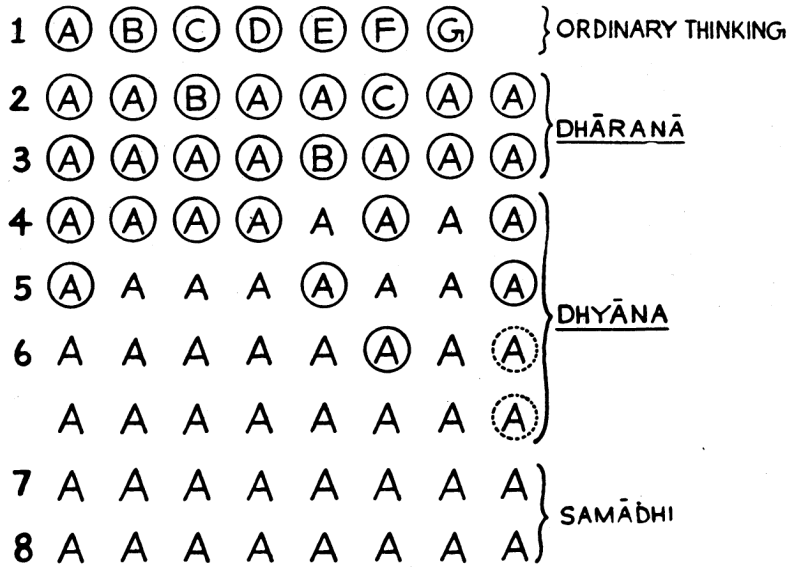
SILENCING THE INTERNAL INPUTS

There is really only one antaranga method, and it is called **samyama**. Samyama involves three major practices that bleed one into another and culminate in samadhi. The three stages are called dhyana, dharana and samadhi.

Western authors generally translate these as: dhyana = concentration, dharana = contemplation, and samadhi = meditation. However, these translations are useless because they fail to indicate that samyama is an

altered state of consciousness with no counterpart in our normal waking state. There can be no counterpart to samyama in waking, because the waking mind is vikshepa, distracted. Mastery of bahiranga is an absolute prerequisite for practicing and performing samyama.

As usual, I. K. Taimni has a diagram and explains samyama better than I ever could:



> "The difference between the three phases of the same process, which culminates in Samadhi may be represented in the following way. If A is the object chosen for Samyama (e.g. the pratyaya) and B, C, D, E, etc. are distractions, then the content of the mind at regular intervals of successive moments in the three phases may be represented by the following series of Pratyayas present in the mind. The circle round the letters represents the mental self-awareness referred to above.
>
> It will be seen that the frequency of distractions goes on decreasing in Dharana and frequency and degree of mental self-awareness goes on decreasing in Dhyara. In Samadhi

> there is complete freedom both from distractions and self-awareness and the object alone remains in the field of consciousness."

This diagram depicts how samadhi is the holding in mind of a single thought, a single pratyaya. In addition Taimni has indicated the observer/observed fusion when the letter A is not circled. As seen, dharana consists mainly in maintaining A against other thoughts. In dhyana, the fusion of the observer with pratyaya A is intermittent. In samadhi, A is held continuously in a state where the observer/observed is fused into one unified pratyaya in the mind.

This intense, continuous focus on the pratyaya is likened by Krishnananda to be like a constant bombardment of the pratyaya by the mind of the yogi. This effort "cracks" the pratyaya and reveals, ultimately, the artha within the pratyaya.

SOME ADDITIONAL COMMENTS

Yoga, *real* yoga — not this funny hatha yoga stuff that pretty women make instructional videos of — is not something one does casually on a Saturday afternoon. Even my limited experiences lucid dreaming required an obsessive, unrelenting effort that eclipsed everything else in my life. Yoga requires this much effort times the biggest number you can imagine. It is, in fact, a life choice. One either chooses the world, or chooses to do yoga. This aspect of yoga has some relevance that we discuss at the close of this essay. But for the moment, we can neglect this aspect and discuss the practices in the abstract, as methods for producing knowledge and releasing power.

The description of samyama above harkens back to my metaphor of the mind as either a big fluffy, diffuse cloud, or the mind as a hard, dense concentrated point. Samadhi is the later, and, as already has been discussed, results in the fusion of the yogi's consciousness with the consciousness of the pratyaya.

Another metaphor that might be more apt at illustrating the power-releasing side of samadhi is to compare regular light to a laser beam. Regular light, such as natural sunlight here on the surface of the Earth, is unpolarized, diffuse, and contains many frequencies. On the other

hand, we can now make lasers that are concentrated beams of polarized light of a single frequency.

Both forms of light have power. Regular sunlight can heat our bodies on a warm day. But a laser can burn through our body, burn through dense material substances. The concentrated light of the laser is simply stronger. This analogy is very apt. The mind conditioned by sensory perceptions is like diffuse sunlight, and the mind in this state is used by scientists to extract jnana from sensory perceptions. The mind in samadhi is like a very powerful laser beam, and it extracts artha from the pratyaya.

Performing samadhi is not the end point of yoga. It is the beginning. Yoga is done for a reason. Yoga means "joining" and the purpose of the methods described above is to effect the joining. Patanjali's aphorism 1.3 describes the joining, the expected end result of yoga: "The Seer abides in its own nature". This need not concern us in the discussion of the methods. But, for the sake of completeness at this point, it has to be explicitly stated that samadhi is not an end in itself.

Once the ability to perform samadhi is achieved, samadhi is used as a tool to effect the joining. The importance of knowing this in the context of this essay is that it explains to what end the power released in samadhi is used. The power released is not used to cause changes in the physical world. By the time one learns to do samadhi, the physical world is inconsequential to one's concerns. No, instead, the power is used in a long series of further stages to effect the joining where consciousness returns to itself, free from any disturbance whatsoever.

To wrap up: having outlined the methods of yoga in a most cursory, but I hope reasonably complete fashion, we are now in a position to understand how the pratyaya, which, after all, is just a thought in the mind of the yogi, can itself be conscious, and how the laser-like consciousness of the yogi can release the artha of the pratyaya and thereby gain siddhis.

PART 7: WHY SCHRÖDINGER'S WAVE EQUATION WORKS

Summary: We have now built up to the turning point of the essay. Here we crack the nut of the link between scientific discovery and samadhi.

BEING PUT IN PLACE

We in the West pride ourselves on our hard-nosed realism and objectivity. However, when seen from the perspective of Hindu philosophy, we are neither realistic nor objective, but simply ignorant. The Hindu mind is literal and material in a fashion far beyond the Occidental imagination. Both great civilizations have taken different aspects of

experience as axiomatic and constructed theories, methods, and ways of life, accordingly.

In the West, we take the world to be real. Due to the influence of the ancient Greeks, time, space, matter, energy, and causality are axioms to the Western mind. At the fringes of our science and philosophy these are debated. But in the nitty-gritty core of our culture, in our everyday lives, these ideas dominate our experience.

As detailed in Part 5, ancient Indian discovery went "inward" and this led to the invention of yoga. Thus, the axioms of Hinduism do not involve the external world, but instead involve the mind and consciousness. These are approached with a realism and literalism that is not only beyond Occidental imagination but beyond Occidental experience.

However, in spite of these vast differences, the approaches converge. After all, we inhabit the same universe, so this is to be expected. Thus, we can intelligently use Hindu ideas to understand science, and vice versa. The differences factor into the scope and implications of each world-view. While I am sometimes critical of the West, it must be recognized that what is going on here is the attempt to have the two world views shed light on each other. It may not be an equal illumination from both perspectives, but both contribute to illuminating a synthesis that transcends either.

To really understand how the experience of samadhi illuminates the experience of science, we need to go deep into the Hindu mind and bring to the fore ideas that are superficially unfamiliar to the Western mind, yet evoke a deep resonance because of their truth.

CONSCIOUSNESS IS BEING

The title is taken from Chapter 67 of Krishnananda's The Study and Practice of Yoga. Here he attempts to explain in words what can be considered the primary axiom of Hindu and yogic experience:

> "A great thinker said, "I think, therefore I am – cogito ergo sum," but this is to put the cart before the horse. We do not think because thoughts are the cause of our being. Rather, our being is the cause of thought. Our existence is prior to the very process of thinking. "I think, therefore I am," is not

> the way of putting it. Instead we should say, "I am, and therefore I think."
>
> "The thinking is a subsequent arrangement which comes into manifestation in respect of external relations, but there is a prior being which is the reason for and the condition for the processes of thought in respect of objects."
>
> "Minus content, what is consciousness? It looks featureless. But it does not mean that DRISIMATRAH, or the pure consciousness condition, is a featureless transparency bifurcated from the content."
>
> "If we attribute being to objects, and consciousness is to be regarded only as a process of knowing, it would be divested of the being [attributed to] things, and consciousness would be non-being; it would be non-existent. But that cannot be, because being is what gives value to anything. Minus being, nothing can be. Therefore, the being of a thing cannot be divested of consciousness; and vice versa, consciousness cannot be divested of being. Existence is consciousness, and consciousness is existence. They cannot be separated."

Convincing the reader is not the main point of sharing this argument. The point is to illustrate how the Hindu mind works. To reword it perhaps more concisely, he is asking: what is the precondition for thought? Two things are. First, to exist, to be, is a precondition for thinking. This is self-evident (and thus an axiom): how can something think when it does not exist? The second precondition is consciousness. How can there be thought without awareness? To the Hindu mind this is also self-evident, it is axiomatic. However, in general, this is not an axiom to the Western mind.

FRANKENSTEIN'S MONSTER

Because of computers, programming, and advances in neuroscience, we entertain the notion of "intelligent machines" and have science fiction fantasies of self-aware computers. This is nothing new, but has always existed in the Western imagination: the homunculi of the Middle Ages, Frankenstein of the Victorians. But in fact, such things do not exist in the physical world except in the imagination, along with unicorns and Mickey

Mouse. Musings of inventing conscious living things stem first, from an overinflated sense of self-importance of the Western ego. As if our machines and technologies can create consciousness. This is pure hubris.

Such delusions stem from the fact that the Western mind does not clearly demarcate consciousness from the content within consciousness. Instead, it tends to treat these as synonymous. Hence the fantasies of creating conscious beings are associated with performing computations that are like those occurring in the brain. And this in spite of the fact that computers already ape many aspects of human thought, illustrating the dissociation of mental operations from consciousness. Of course not all authors confuse consciousness and its contents, thankfully. For example, Bernard Baars' clearly distinguishes consciousness from its contents in his global workspace theory published in his book COGNITIVE THEORY OF CONSCIOUSNESS (here).

The reason the Hindu distinguishes consciousness, as a thing in itself, from the specific contents of consciousness, such as thoughts, emotions, acts of will, desires, etc., is because of the experience of yoga. Recall from Part 6 that the purpose of yoga is to cause all motion in the mind to stop ("chitta vritti nirodhah"). When this is performed, it is discovered that something still exists: a naked, empty, pure self-awareness.

SAMADHI ON CONSCIOUSNESS

We have spoken to this point of samadhi performed on a pratyaya, a thought within the mind of the yogi. This type of samadhi is called "sabīja samadhi" (see also), where the pratyaya, the object of meditation is called a "seed" or "sabija". In addition, there is "nirbīja samadhi" or samadhi without a seed, without a pratyaya. This is the most advanced form of samadhi. It is the ultimate goal of all samadhi practice to achieve this state. So, if there is no "seed" in the mind of the yogi, what then is the object of concentration? It is consciousness itself.

It is the experience of yoga that consciousness can be stripped, emptied, of all content, yet something remains. This something has two properties. One characteristic of the state of nirbīja samadhi is existence. Existence does not cease when consciousness has no content. Second, there is awareness of being aware, which is pure self-awareness. The state of nirbīja samadhi is

awareness of being aware, and nothing else. In this state is only consciousness and existence. Hence the formula consciousness = being.

We should celebrate the discovery of this state as one of the greatest discoveries of yoga, and of mankind.

We are now positioned to state a major insight of this essay. According to the line of reasoning above, when any object is perceived by the senses, it obviously exists (of course excluding mistakes in perception). Since it exists, there must be consciousness because consciousness = being. The implication of the experience of nirbīja samadhi is that **the mere existence of a thing implies the presence of consciousness**. This provides a logical argument as to why Hindus see all things that exist as consciousness. Of course, to a yogi it is not a matter of logical argument because these things are directly experienced in samadhi. But for those of us who do not experience samadhi, there you go, I've given you a logical argument.

We in the West need an argument, a rationale. The Indian mind does not. Over millennia of integrating the insights of yoga into their culture, the idea that being = consciousness is axiomatic to the Hindu mind.

Now, it is naive and stupid to think the yogic logic is so daft as to insinuate that everything that exists is conscious the way you or I are conscious. This is NOT what they are saying. If something exists, there must be consciousness associated with it. To what extent it is conscious of specific contents of greater or lesser richness, to what extent it can act in a lesser or greater capacity depends on the structure and constitution of the thing. But the implication is that even the most rudimentary structures that exist have consciousness.

This viewpoint exists in Western philosophy and is called panpsychism. However, to the Western mind, this is merely an interesting, or absurd depending on one's attitude, hypothesis. Panpsychism competes with a plethora of other views of Nature found in the mental jungle that is the Western intellect. To the yogi, the consciousness of objects is a direct experience. It is the consciousness at the core of any existing thing with which the yogi fuses in samadhi.

THE STUFF INSIDE OF CONSCIOUSNESS

We can now understand the distinction between mind and consciousness in yogic thought. Consciousness is like a container, or a medium, with two properties: (1) it is, and (2) it is self-aware. Mind is any pattern inside the container. The general word for any pattern in the container of consciousness is "vritti"; a wave or whirlpool in the medium of consciousness. The vrittis in consciousness share the properties of the medium: they exist, and they are associated with self-awareness. Any conscious activity co-occurs with self-awareness. There are degrees of self-awareness associated with operations in the mind, but that topic is addressed in a later essay.

The vrittis are categorized in a very complex fashion in Hindu thought. Taken in total they are called "Prakriti": the totality of all manifested existence. The term "Prakriti" is often translated as "Nature" or "Mother of all matter" or similar such terms. Prakriti is the source of the gunas, discussed in the Prelude. The gunas are the three types of dynamical patterns. They are called rajas, tamas and satva. We can only understand the gunas by way of our modern understanding of Dynamics. The gunas are dynamical systems with different types of attractor states. Tamas is the dynamics of fixed point attractors. Rajas is the dynamics of strange attractors. Satva is the dynamics of limit cycle attractors.

As explained in the Prelude, to the Hindu mind, all things that exist are made of the three gunas, the three general types of dynamical patterns, mixed in different proportions and combinations. The gunas form all the patterns found in consciousness, including the physical world, the mental world, and other deeper worlds of which the West is unaware.

THE MIND-BODY PROBLEM: NO PROBLEM!

The mind-body problem, the link between the body and mind, between the physical and mental, has been a perineal problem in the West since ancient times. There is no mind-body problem in yogic and Hindu thought. It is an incorrect dichotomy in their view. There are only the gunas, the dynamical patterns. This is why mind can act on body and body can act on mind, why matter and mind can interact: they are both made of the same "thing". But this "thing" is not a substance. Both mind and matter are constructed of

dynamical patterns. That is what it means to say that everything is made of the gunas. Since mind and matter are both dynamical patterns, they can interact with each other. No big deal. End of story.

Of course, in practice it is not so simple. Mind and matter are different TYPES of dynamical systems, just as the flow of a river is different from the flux of light from the Sun. But just as the dynamics of photon flux from the Sun can interact with a river on the Earth, the dynamical patterns that we perceive as atoms and bulk matter can interact with the dynamical patterns that we perceive as thoughts and ideas. Meanwhile, both sets of dynamical patterns are just vrittis, patterns of gunas, in consciousness.

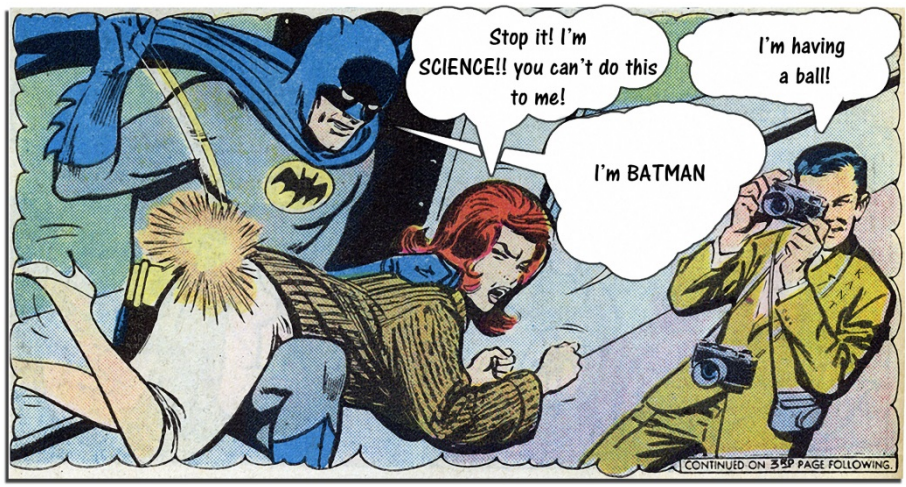
We have already pointed out two critical facts about the relationship between mind and matter:

1. We cannot just think any arbitrary thought and bend matter to our will, and
2. We can think highly specific, highly technical thoughts and bend matter to our will.

How this happens is exactly explained by the discoveries made by yogis. It is because a physical system is a highly specific dynamical pattern (combination of gunas, to use the Hindu term). If we can match that highly specific dynamical pattern to the dynamical pattern that is our thoughts, then we can interact with the physical system. The process is no different, in essence, than the Sun heating water. It is just the interaction of two different dynamical systems.

This "matching" of the dynamics of thought to the dynamics of sensory experience is what we call science. Note that when stated in these terms, it is clear that the entire process occurs within consciousness. We match perceptions at two different levels of consciousness; sensory perceptions are matched to mental perceptions. The whole process occurs within consciousness. When understood in these terms, it starts to become clear how samadhi can reveal the svarupa and artha of the pratyaya only within consciousness.

PART 8: THE GRASS IS ALWAYS GREENER ON THE OTHER SIDE...



Summary: Part 8 of this 10 part essay confronts possible objections to the yogic view of consciousness by discussing some of the weak links in the contemporary scientific view that sees consciousness as an emergent phenomenon of physical matter.

In Part 7 we established the yogic basis whereby consciousness is associated with the objects of perception. In the philosophy of mind it is a favorite pastime to point out that consciousness is private (something about "bats" I believe? Or was it Batman?), and that we can only infer consciousness in other beings based on our personal, private experience of consciousness. This is a state-dependent truth. It is true when the mind is in the state of vikshepa. Not only is consciousness a private affair in the state of vikshepa, but Kant's rules also apply. We cannot understand a "thing in itself" when in the vikshepa state. But the privacy of consciousness and the limits of reason are not true in general. As we have repeatedly discussed, the person in samadhi fuses with the consciousness of

the object of meditation (pratyaya), and in doing so directly experiences the object as a thing in itself, as its svarupa.

But how is this possible?

TEAR DOWN THE WALL

The very suggestion of the possibility of samadhi is absurd on the face of it to the Western mind that sees consciousness as a private experience. Further, in the West, consciousness is relegated to creatures with nervous systems. In Early Modern Europe, at the time when modern science was founded, many were of the opinion that animals did not have "souls", meaning mind and consciousness. Over time, religious connotations were divorced from psychology, and the idea that animals did not have souls gradually transformed to what we have today. Today consciousness is considered by most people as a property of life, and as a consequence of nervous systems. Since nervous systems display a gradation from simple to complex, it is inferred that the corresponding conscious experiences are similarly graded. From this view it is absurd to consider that a plant, fungus or bacteria has consciousness as they lack nervous systems. However, living cells in general possess the property of "irritability" which is the ability to seemingly teleologically respond to environmental perturbations. Some have taken cell irritability as a basis for consciousness (see Llinás here). However, the buck seems to stop at inanimate, nonliving matter, such as rocks, planets and stars. These are not alive in any obvious sense, and to assert they have consciousness makes no sense to the modern Western mind.

The exception to this way of thinking was mentioned previously: panpsychism. Panpsychism generalizes the idea of a gradation of consciousness to all material entities. In panpsychism, consciousness is taken as a basic attribute of matter. The core of panpsychism is the concern: how can consciousness emerge from non-conscious components? This presents a philosophical dilemma of the same form as the questions: how can something arise from nothing? or how can mind and matter interact if they are fundamentally different? Panpsychism avoids this paradox by positing consciousness as a basic property of matter. Matter has energy, mass, inertia, etc., and it also has consciousness.

However, a more accepted view, one consistent with materialism and physicalism, treats consciousness as an emergent property of some material systems, specifically nervous systems. From the emergence view, if the preconditions for the arrangement of a conscious system can be instantiated in other material systems, then supposedly, consciousness would also emerge. This is the basis of the "artificial consciousness" crowd. Emergence ignores the conscious/non-conscious dilemma by demoting consciousness to a type of information processing, and does not see consciousness as constituting a unique phenomenon or category of its own. (Part 7 discussed the yogic solution to these issues in terms of the gunas).

Panpsychism is an interesting logical possibility, and certainly one way to solve the mind/body problem. But it convinces no scientist, and goes against the grain of direct observation. Rocks, clouds, planets, electrons and stars do nothing to indicate they are conscious, in the way, for example, that people or animals display evidence of consciousness. Thus, panpsychism is tolerated and ignored, and the emergence view dominates scientific thinking, especially in the neurosciences where this issue is of direct relevance.

Thus, there is a seemingly fundamental impasse at this point. The yogic claim that all existence is associated with consciousness simply makes no sense to the modern mind that sees consciousness as a private experience of living creatures and an emergent property of nervous systems.

WE JUST KANT GET IT RIGHT

To get over this impasse requires deconstructing the idea that consciousness is a property only of nervous systems. While the notion seems self-evident on its face, it actually vaporizes upon intense scrutiny. The scrutiny needs to focus on the scientific basis on which any study of complex systems will depend. A major effort in this direction has already been completed. This is why Immanuel Kant is famous.

Kant concluded that our experience of the world is a function of how our minds are constructed. What he called "a priori categories" can be expressed in more modern terms as the building blocks of our minds. Kant saw the elements of our sensory consciousness, time, space, causality, etc.

as basic building blocks of our minds and not properties of the world per se. As to the properties of the world per se, this was the idea of "thing in itself". We could never know the thing in itself because we are forever forced to perceive and think about the world from within the eternal prison of our own minds.

This is Kant's transcendental idealism. The conclusions were true when he realized them and they are just as true today, in spite of an additional 300 years of scientific discovery. From Kant's point of view, just like that of the yogic point of view, our modern sciences do not reveal the truth, the svarupa, of the studied objects, but instead reveal the truth of how our minds perceive the studied objects. Science is the study of the regularity of sensory and mental events

It is very hard to emphasize the absolute nature of Kant's conclusions. We are prone to think that our knowledge of the brain and the sense organs, the whole story of cognitive neuroscience in all its grand complexity, overcomes Kant's dilemma. Surely what we know of the brain explains how brain function constructs the mind. What need is there to posit a mysterious "thing in itself" when we now have a relatively deep understanding of the cognitive neurosciences?

First, to entertain such ideas indicates one has only a superficial knowledge of the neurosciences. There is no such exact knowledge of the link between brain activity and first-hand subjective mental experience. The best we have today are the sloppy arts of neurology and anesthesiology (and this is said with all due respect to my medical colleagues whom know to what I refer). These physicians daily deal with the correlations between the human brain and mind. The deeper one understands these medical specialties, the less confident one is to make generalizations about the link between mind and brain. Inferences about consciousness made from studying rat, mouse or worm brains are extremely circumscribed, in spite of the propaganda of neuroscientists who need to keep their funding intact.

More importantly, however, to think that brains explain minds is to completely misunderstand Kant's point. Everything we perceive, including brains and nervous systems, are the result of a mysterious process by which the thing-in-itself is transformed into that of which we are aware. Behind the perception of brains and nervous systems are mysterious things-in-themselves that are, according to Kant, forever inaccessible to direct knowing. We perceive and interact with brains and neurons (not in

everyday life, but, for example, in labs like mine), but what these are as things in themselves is something we can never know. Kant's is a very absolute position, when understood correctly. Everything we know is a construction of the mind: not just time and space, but all the STUFF in time and space, including brains and nervous systems. We can only know what is in the mind. Period. There is no other way to know.

This last sentence is the Achilles' heel of Kant's view. There is only one legitimate criticism of Kant: Kant did not know yoga. Yoga teaches other ways to know, specifically, samadhi. Therefore, the only escape from Kant's mental prison is yoga. Nothing else will work. Anything else is but the bouncing off the walls of the mind-prison Kant so verbosely described.

Unfortunately, Kant's insights were not used as a clarion call for scientists to first understand the "mind as middle-man" before describing objects of the world. Instead, Kant is, effectively, the father or post-modernism. As outlined in Part 5, for a short while in the nineteenth century it seemed as if Kant didn't matter because scientific progress was so spectacular. The first quarter of the twentieth century proved this wrong. But no one revisited Kant. Instead, critiques of objectivity pushed the objective/subjective war back to the idealistic camp, without calling it as such, and we ended up with the focus on linguistics characteristic of post-modernism.

Post-modernism is not an invalid line of thought. As stated previously, dissection of sabda is an important part of yogic practice and is a precondition for deeper yogic practices. So, had the 20th century Western civilization followed a rational path of intellectual evolution, the swing back to idealism would have been embraced, and the sciences would have teamed with the new approaches to subjectivity, the latter conditioned by some 2000 years of philosophical inquiry. However, this did not come to pass, and today there is only greater divergence and hostility between science and modern philosophy.

However, leaving all this sound and fury where it belongs, what if Kant's transcendental idealism was accepted as a legitimate scientific insight?

LIMIT THEOREMS

Quite contrary to the classical idea that science is the discovery of objective facts, a key lesson of 20th century science was the appreciation that

scientific activity reveals "limit theorems". Einstein deduced that matter must always move at a velocity less than the speed of light. It is a fundamental limit of Nature. After blowing away the fog of science fiction, it is a fact that anything with mass cannot accelerate to the speed of light, let alone go above it. Further, there is no prospect of this happening on the horizon. Heisenberg showed that we can never measure physical systems with perfect precision. It is called the "uncertainty principle" because the error of quantum measurements will always be a number greater than zero. The 2nd law of thermodynamics, perhaps the first of the limit theorems to be discovered, means that a perpetual motion machine is impossible. Chaos theory, or the dynamics of strange attractors, proves that, since we cannot measure to an infinite degree of precision, we will never be able to predict the long-term outcome of a chaotic dynamical system. Gödel proved that all true theorems cannot be deduced from a system of axioms. Turing proved that the halting problem cannot be solved.

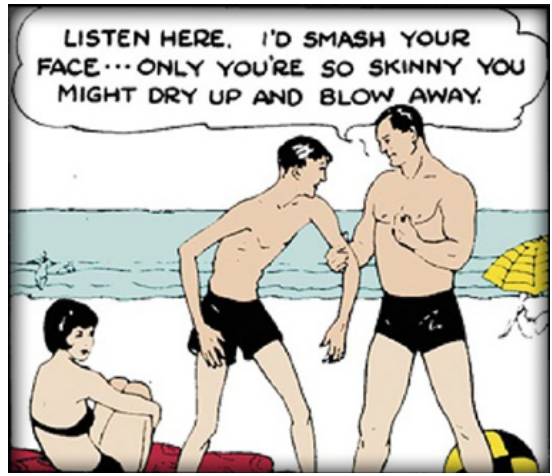
Each of these results imposes limits on our ability to measure or deduce the properties of nature. Such "limit theorems" are a hallmark of modern scientific thinking. [It is interesting to note in passing that discovering the empirical limits of reason has released so much, artha, power, in the form of technology; again, a point for parts 9 and 10].

Kant's transcendental idealism is a limit theorem: we can never know the thing in itself. It could be the fundamental limit theorem of psychology. Of course no one thinks of it that way. Kant has never been taken seriously in science. Too bad, because Kant's conclusion is correct, at least relative to the vikshepa state of the mind in which science is performed.

So we are in a position today where honest and smart scientists struggle with basic issues in physics and neuroscience, at the intersection of the observer and the observed, the subjective and the objective, mind and matter. These people struggle with needless inefficiency, in large part, because Kant has been relegated to the dustbin of philosophy.

INFINITE PRECISION

Deconstructing the Western view of consciousness from the yogic point of view almost isn't fair. It's kind of like this old familiar comic book advertisement:



What's the skinny guy doing with the hot chick in the first place? Is it his sister?

But oh well, let's end with one example….

Let's consider the yogic take on the nature of empirical knowledge, which, recall, is called jnana. Krishnananda explains this in a lucid passage (taken from Chapter 43 of THE STUDY AND PRACTICE OF YOGA):

> "…we cannot know this secret about the nature of the world as long as we are in a world of relativity where everything is determined by everything else, so that nothing can be known absolutely. We are caught up in a peculiar difficulty in the understanding of the essential nature of any object in this world on account of the relatedness of this object to everything else in this world, so that we cannot know anything unless we know all things."

This is perhaps the hardest idea for the hard-nosed, hard-headed Westerner to grasp. No matter what is empirically discovered and described, the description will always be incomplete. Because all objects are real objects in the real world, and all the objects in the world interact via a variety of forces, one will never know how these interactions will play out with the specific system under study. Thus, we are forced to consider specific instances in terms of statistical populations. An important consequence of

limit theorems is that we can only generate an intellectual caricature of reality; a ham-fisted outline that captures some facets but is incapable of capturing others. Granted some of these caricatures have operational utility in specific instances (for example quantum mechanics). But the utility rapidly falls off with increasingly complex systems. Quantum mechanics is useless for telling us the principles of how living cells work, for example. When we get to biology, brains, the human mind, and human events, statistical methods become mere descriptive tools that are so impotent they produce the wrong result half the time.

If we can't even understand pathology, what makes anyone so smug that the same methods will allow understanding of consciousness?

So, the Western view of consciousness can be construed as a case of one hand not knowing what the other hand is doing. Those who think we have a handle on consciousness, who posit emergence of consciousness in specific systems of matter but not others, fail to account for the limit theorems of 20th century science and ignore Kant's insights, resulting in ideas that amount to poetry...about bats and stuff. Gödel and Turing's results are mathematical proofs. If we cannot solve some easily stated problems in mathematics, then it is preposterous to suppose we can solve the problem of consciousness by the usual means at the disposal of the Western mind.

This is the negative view that tears down the wall of ignorance we call "Western learning". The next installment will consider the constructive, positive view that puts "Western learning" into some kind of anchored perspective.

PART 9: THERE ARE OTHER THINGS THAN THE MIND IN THIS VAST PANORAMA OF CREATION

The ever-changing gunas. Americosmos courtesy of Darrin Drda.

Summary: In Part 9 we introduce yogic cosmology as the means to understand how science and mathematics describe the natural world.

SKIPPING ROCKS

Yoga and science each have their own methods for reaping knowledge from the world. By understanding these differences we come to understand science in a new and deeper light. That is, after all, the purpose of this essay, recalling its title is: *What is Science?*

The difference can be summarized thus: science skims the surface of the world to acquire knowledge. Occasionally, via this skimming process science plumbs below the surface in an irregular, haphazard and unsystematic manner. Science is like Brownian motion; movement that may momentarily appear to have purpose, but is without direction when viewed over the long term.

Yoga dives beneath the surface and into the depths of the world. It does so systematically. Yoga does not stop at any particular depth below the surface. Yoga goes all the way to the center of the world, and thus acquires ultimate experience. It is the ability to contrast experience at the surface of the world, which is the condition of relative becoming, and the experience at the center of the world, which is the condition of absolute being, that allows yoga to shed light on this activity we call science.

Because yoga seeks to silence movement, vrittis, in the mind, it is acutely concerned with how the senses function. This is in contrast to most sciences that take for granted that the objects as presented by the senses can be taken for granted.

Yoga offers an elaborate integrated scheme of the effect of the senses on the mind, and the relationship between the senses and the objects of perception. Yoga not only understands sensation in terms of the mechanics of sensory contact with external objects, but looks much deeper at the effects of sensory input on the mind. The effects of sensory stimulation percolate through and grow within the mind, something like weeds in dirt, forming very complex mental and emotional structures. These are composite structures of sabda, jnana and artha (see Part 4). Let us look at the sensory processes that give rise to these complex vritti structures in the mind.

ON THE SURFACE

Our modern understanding of sensory physiology is consistent with the yogic understanding. The senses interact with objects by, for lack of a better term, bouncing off objects. No direct contact between senses and objects ever occurs.

Vision is caused by photons emitted by or reflected off objects. The photons are a middle man between the object and senses. Hearing, like

seeing, is mediated via sound waves acting as middle men. Touch is perhaps the most paradoxical of sensations. With touch, it appears as if we make contact with the object. But physics teaches us that the interaction is the microscopic repulsion of electron clouds generating inertia at the macroscopic level. Thus, touch is repulsion between the sensors and the object; touch is the exclusion of the object from the senses. Taste and smell are perhaps the most intimate of the senses because microscopic pieces of the object enter the mouth and nose, respectively, and mediate a touch-like interaction at a molecular level. Again, however, the essential forces involved are those of the repulsion of the electron clouds of the odorant or gustatory molecules with the receptors. And more importantly, what is conveyed by taste and smell are pieces of the object that were expelled from the object.

Thus, via this "bouncing off of" action of sight, hearing and touch, and to a lesser extent smell and taste, the senses reveal only the surface of external objects.

Neuroscience therefore confirms the yogic insight that sensation is a non-contact phenomenon. The emphasis in yoga that sensation is a form of non-contact with the objects of perception derives via contrast with the experience of samadhi, where there occurs a literal fusion of the object and the observer. They are opposite extremes in a spectrum of knowing: contacting merely the surface of things by a "bouncing off of" process, as opposed to actually becoming the thing.

The senses become "excited" due to being repelled by objects and convey this excitation into the brain. In the brain, extremely complex patterns of electricity are generated. In turn, the electrical patterns generate vrittis, waves, dynamical patterns, gunas (choose your favorite term, they are all the same) in the mind. It is the vrittis that constitute the elements of direct, first person awareness. We are therefore only directly conscious of the far distal effects of sensory activity that occur at the end of a long chain of complex events.

The patterns in the mind reflect only the surface of the object and none of its interior. If we cut a thing open to inspect its interior, we encounter only new surfaces. And so it goes all the way down to quarks, and all the way up to the largest scale galactic structures. "Things within things within things within things" is the end result of sensory perception. The mind only knows surfaces within surfaces within surfaces, like the Russian nested dolls.

The structure of the world.

Further, nothing perceived is static. Everything moves. Everything is dynamic. What appear to be static surfaces at a low magnification are resolved to be patterns of movement at a higher magnification. This point is driven home in the following exchange between a 2nd grader and physics instructor (original here):

> Student: "… is a quark bigger or smaller than an electron?"
>
> Physicist: "A quark has never demonstrated any measurable size…The size of a proton or neutron comes from the motion of the quarks as they orbit around each other…the proton/neutron is essentially a cloud of motion…It is this cloud of motion that gives the proton/neutron its size."

What we are aware of in our minds are dynamic patterns (gunas) that create mirages of solidity at more macroscopic levels, but dissolve into only motion when intensely scrutinized.

HOW WE EXTRACT JNANA FROM SENSATIONS

Part 4 described yogic knowledge theory that defines thinking in the vikshepa state as a mixture of sabda, jnana and artha. To review: Sabda are the arbitrary symbols associated with external events and (seeming) objects. Jnana is empirical knowledge: the mind shaped by sensory events and associated thoughts. Artha is the true essence of a thing.

It was claimed previously that science works by eliminating sabda and extracting jnana from sensory consciousness. Let's illustrate this process by example. Consider the idea of gravity. Of course we see things fall down all the time. That is the sensory fact. We also see stuff move in the night sky. That is also a fact. We now know that both sensory experiences are the result of gravity. But it wasn't always so, and this idea has undergone a few major transformations over the past 2000 years.

First was Aristotle, who thought that falling down was an attribute of things that fall down. This idea did not allow him to link movement on Earth with that of the heavens. It also prevented him from seeing gravity as a thing it itself. Aristotle's view was the forerunner of the idea of mass or inertia, but it was blind to the idea of the gravity force as a thing itself.

Newton recognized there were really two things going on: there is mass, which has the potential to fall, and there is a force that acts on mass, gravity, that actually makes things fall. Newton therefore linked sensory experiences of the Earth and the heavens. He made an equation for this and it all seemed settled, even though people, including Newton, did not like "spooky" action at a distance.

A couple hundred years later, building on the work of many people, Einstein saw a new way to link gravity and mass, and radically transformed Newton's force into the bending of space-time in General Relativity. We know today that Einstein's view cannot be the whole answer because it cannot be reconciled with quantum mechanics. Physicists are currently working very hard to find the next theory of gravity.

Let us dissect this process in yogic terms. First there are the sensory experiences: the perceptions of things falling down, or moving in the night sky. By itself, sensation means nothing and must always be interpreted by the mind. The sabda aspects are the words and ideas used to explain the sensory experience. Jnana refers to the progressively accurate correspondence between the words and ideas, on one hand, and the

sensory experiences on the other. Aristotle was not wrong; he just didn't have the whole picture. The same can be said for both Newton and Einstein. We thus see a progression where the *meaning*, the understanding, more accurately reflects what the senses had been conveying all along. So, jnana refers to those meanings in the mind that accurately correspond to sensations.

What of artha? The artha is also a form of meaning, but of a different quality. Aristotle's idea didn't have much artha in it. Its main power was to propel other people to keep wondering why things fall. But Newton's ideas actually tapped into artha, because now, the meaning could be used to extract power from the world and to cause rational changes. Newton's ideas gave us superpowers. Einstein's ideas tapped even deeper into the artha of gravity. A whole new level of power could be extracted, as Hiroshima and Nagasaki found out the hard way.

Compared to sabda and jnana, artha is very hard to intellectually characterize. It is meaning that allows the release of power from the world. That is the easy way to say it. But to state exactly the characteristics of this meaning is probably impossible, though we will attempt to do so in the next section.

There is an important feature of science that our single example illustrates. We are forced to always update our notions of objective reality in science, even in deductive sciences like physics, let alone inductive sciences like biology. Similar stories as above can be told for every science.

It is the cultural norm of science that all ideas are tentative: tomorrow's knowledge will be different from today's. This is ironic. Scientific culture accepts tentativeness and rejects the possibility of certainty, yet is poised to forever seek such certainty. This is the contorted posture science is forced into to cope with Hume's problem of induction. This is forever the consequence when the thing in itself is inaccessible; the way of the senses.

ARTHA

One way to understand artha is to quote from a song by the 1970s progressive rock band Yes: "Catch the wind and hold on tight to what you find…"

What do you find when you try to catch the wind?

Artha is beyond the sensory-conditioned intellect. Part 8 pointed out the irony that even though true scientific activity results in limits, it is through those limits that power is released. In a very indirect and oblique way, the whole history of science is Kant's program to define the limits of reason. The limit theorems of science are the limits on reason forced on us by the input of our senses.

What is a limit? It is something that cages and confines. A limit stops movement. Now, I will use the world limit in another sense also, in the sense it is used in calculus. We can speak of the limit of 1/x as x goes to infinity. In this case, the limit is zero. Consider this: what would be the (calculus) limit if all limit theorems were known? Knowing all the limit theorems would stop the mind from moving in all arbitrary directions. The limit of all limit theorems would be perfect knowledge. At this limit, the mind would not even move at all. It would be a state of perfect equipoise, being balanced on a razor's edge. It would be yoga.

MATHEMATICS AND ARTHA

A crucial ingredient in the development of Western science and technology is the marriage of science and mathematics. What do we see in the progression of Aristotle → Newton → Einstein? We see the progressive reliance on math and the decreasing reliance on the senses. Aristotle used no math and his ideas released very little power, if any at all. Newton's math was grounded in sensory perceptions: apples falling, planets making trajectories through the sky. Nonetheless, power was released from his ideas. Newton was part of the genesis of the industrial revolution. By Einstein, the senses are pushed out of the picture. No one has ever had a sensory experience of riding along a light wave. Like Mickey Mouse and Unicorns, this existed only (initially at least) in Einstein's imagination. But he was able to translate these musings into math and invent his Theories of Relativity, and again, for the umpteenth time, much power was released.

We hit here on a very crucial point that has not gone unnoticed to the Western intellect: What is this "unreasonable effectiveness of mathematics"? This question also leads to serious irony. Science is thought of as hard-nosed, as sticking to facts, which means sensory experience. Yet, time and again, the senses fail. And who picks up the slack? Mathematics does.

But what is math? Math is a specific type of thought occurring in the human imagination, which we define more precisely below. But, unlike fiction novels, Hollywood movies, and unicorns, these imaginary thoughts have a direct correspondence to sensory experience.

But why?

From the Western intellect's point of view, there are many answers to this question, which means nobody knows the right answer. Right now, today, people who think of this issue are awe struck, and mostly confused about it. Consider an extreme example. Max Tegmark, a professor of physics at MIT, has been promoting the idea that math works because the physical world is a mathematical object. This is just plain silly. The physical world is definitely not a mathematical object, and it is difficult to take Max seriously. Professor Tegmark's efforts are useful for illustrating the extreme confusion that plagues the Western mind. He is, in fact, one of the honest and confused scientists working at the intersection of mind and matter.

Can yoga help us understand why math is so effective at releasing artha in the world? Yes it can, but we must learn some more technical yogic ideas first.

INTO THE DEPTHS: YOGIC COSMOLOGY

Previously I pointed out that yogis do not learn samadhi to know things, but learn samadhi for a different purpose. The purpose is to dive into the depths of consciousness; to go from the outer surface of sensory experience to the center of being, where all existence converges. From this experience emerges a cosmology, yogic cosmology. By understanding yogic cosmology we can directly answer the question of why math is effective for describing the natural world, and some other questions that I have avoided answering so far.

Yogic cosmology is defined in aphorisms 1.17 and 2.19 of Patanjali's Yoga Sutras:

Aphorism 1.17:

१७. वितर्कविचारानन्दास्मितानुगमात् संप्रज्ञातः ।

Vitarka-vicārānandāsmitānugamāt sam-prajñātaḥ.

Aphorism 2.19:

१९. विशेषाविशेषलिङ्गमात्रालिङ्गानि गुणपर्वाणि ।

Viśeṣāviśeṣa-liṅgamātrāliṅgāni guṇa-parvāṇi.

विशेष particular; specific अविशेष non-specific; archetypal; universal लिङ्गमात्र a mere mark अलिङ्गानि (and) without mark or differentiating characteristic गुण (of) the *Guṇas* पर्वाणि stages of development; states.

Again, we rely on Professor Taimni to translate for us:

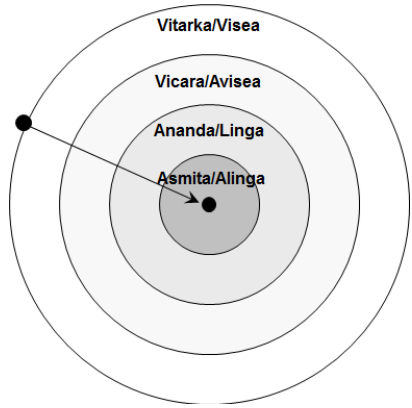
> Aphorism 1.17: "Samprajnata Samadhi is that which is accompanied by reasoning, reflection, bliss and sense of pure being"
>
> Aphorism 2.19: "The stages of the Gunas are the particular, the universal, the differentiated and the undifferentiated."

These aphorisms are a **BIG DEAL**. A whole cosmology is described in two sentences. The aphorisms describe the entirety of the external world and the corresponding levels of mind. Both the external world and the mind are described to consist of four distinct levels, phases, or states. I will use the term "state", in an analogous sense to how we speak of a "state of matter" such as solid, liquid and gas.

Both the external world and mind are described in terms of four different states of the gunas. Recall the three gunas: rajas (chaotic dynamics), tamas (point attractors) and sattva (limit cycle attractors). Each of the three gunas can exist in each of four states as shown in the following table, adapted from Taimni's *Science of Yoga*:

State of gunas	Corresponding state of consciousness	Meaning
Visesa	Vitarka	Specific instances
Avisesa	Vicara	Generic/archetypes
Linga	Ananda	Marked
Alinga	Asmita	Unmarked

I've also prepared the following diagram that illustrates the relationship among the four states of yogic cosmology:



The World and The Mind

THE FOUR STATES OF THINGS AND STUFF

What is the four-fold cosmology of yoga? This now gets us into Unknown Territory for the typical person. According to yoga, the world we perceive with our senses is only one of four co-existing worlds. When one shuts out the world of sensory experience via pratyahara, it is discovered immediately that there are other layers of conscious experience beneath or within the one we are experiencing right now. The other three worlds are altered states of consciousness. In fact, the **yogic cosmology is the map of the possible altered states of consciousness**. It is comprehensive. There is no state of consciousness not contained in the above table.

Talk of altered states scares some people. But it need not. All of us have some minor experience with altered states and we call it "dreaming". When we dream at night, we have transferred our consciousness out of this world and into the adjacent world, called "avisesa". So, if one is scared by these concepts, go work in a factory or retail sales. You have no business in intellectual matters if you cannot handle it.

As the diagram above indicates, the world, existence, Nature, whatever you want to call it, has four levels or states. These states are depicted as concentric spheres, one within another. This concentric arrangement represents the inward descent into the depths of consciousness effected by samadhi. The four states of consciousness listed in the table above are the four sub-types of samprajnata samadhi (samadhi with a seed) as defined in aphorism 1.17 above.

The worlds and corresponding states of consciousness listed above are **the empirical categories of consciousness discovered by yogis**. These are not mere philosophical ideas. Again, they are operational. They are the terms required to describe yogic experience.

In yogic cosmology, the world is a much bigger and much more abstract place than it is in modern scientific cosmology. I'll now briefly describe the four states of matter and mind.

FROM THE SPECIFIC TO THE GENERAL

The outermost state is called **visea** and the corresponding consciousness is called **vitarka**. In short, this outer level is the state of consciousness we are in right now in the world of waking experience. The world of visea is the world we perceive with our senses when awake. All the discussion above about surfaces and such was describing vitarka consciousness in the world of visea.

Visea/vitarka is perhaps most informatively translated as "specific instances of". The visea world is the world of specific people, specific trees, specific planets, specific stars, specific universes, etc. You get the idea. The corresponding state of consciousness perceives these as relatively autonomous objects. But in the world of waking, full of seemingly endless objects, what are these objects specific instances of?

They are specific instances of generic archetypes. **Avisea** means "lacking specificity" or "generic". **Vicara** means "synthesis". Where vitarka consciousness perceives a field full of specific roses, vicara consciousness perceives only the general property of "rose-ness". Vicara consciousness perceives the various archetypes only, and not specific instances of the archetypes. The world of vicara is the world of archetypes. The corresponding consciousness is one of "synthesis", or more informatively, of "generic-ness".

NEWS FLASH for the Platonist mathematicians: Plato's world of mathematical objects actually does exist and it is the avisea realm discovered by yogis. In fact, the avisea realm is the realm of the mind in the dream state. Dreams convey archetypes as meanings, as Carl Jung recognized. This is why dreams make so little sense from the waking standpoint. Dream perceptions convey a different type of information than do the sensory perceptions in the waking world of visea. The waking mind of vitarka interprets dreams in terms of specific instances when in fact the information conveyed is that of archetypical qualities.

But there are many archetypes (infinity actually) and they are entwined in endless complex patterns. The world that reveals how the archetypes interlink is the world of **linga**. Linga means "marked", as in putting an identifying mark on something. By "marked" is meant that the archetypes are distinguishable from one another, in spite of the fact that they are hooked together into patterns. Perception of this world is called "ananda", bliss. Relationships of the most abstract character occur in consciousness at this level. To perceive at this level is bliss beyond anything possible in the waking state. This bliss is very feebly reflected, for example, in the beauty and elegance people feel when seeing good mathematics. However, the understanding experienced here far transcends any understanding of the intellect in vitarka consciousness. This level intrudes into vitarka consciousness via intuitions of Heavens and Gods, the great myths of Humanity, the desire to unify all knowledge, and other such insights.

Finally, although the archetypes hook together in awe-inspiring and mostly incomprehensible patterns, in the final analysis they fuse to form one thing: the totality of existence. The Greeks had a word for this: logos. The Divine Plan. The Divine Plan has many facets. The many facets are seen directly in vitarka consciousness as seemingly individual beings, seen in vicara consciousness as archetypes, and seen in ananda consciousness as patterns of archetypes. But the Divine Plan itself is just one unified thing. When the

Plan is seen in its totality, the various facets of it are “unmarked”, they are “alinga”. The corresponding consciousness, asmita, transcends even the bliss of ananda consciousness. No words can explain; which is why I wrote a poem about it.

WHAT THE BLEEP

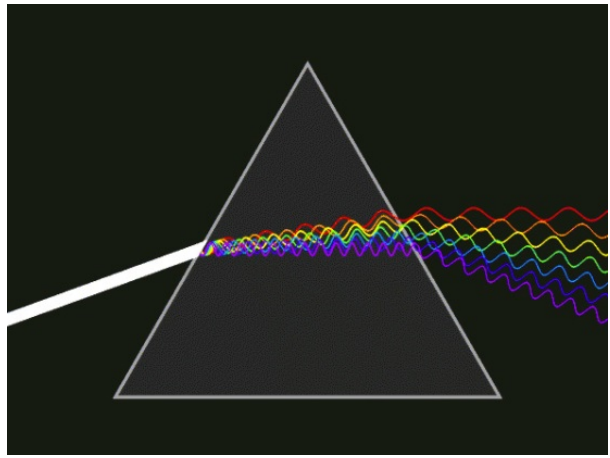
That, in a nutshell, is the Universe discovered by Yoga. Here a few comments are made about this cosmology.

First to be noted is that concepts of an external world go hand in hand with states of consciousness. There is no dichotomy here; each world is identical with a specific state of consciousness. Further, the scheme is all-encompassing. There is nothing one can think that is not within the map. A smart person schooled in the Western view of the world should, if you really understand what is being said, feel stupid and embarrassed in the face of this cosmology.

Second, as seen in the above descriptions, the yogic view of the world, what they call manifested existence, has the general form of going from the general to the specific as you move from the center outwards. It is a common sense way to organize things when you think about it, although the idea has not occurred to Western science. Western scientists look for specific things, like energy, or information, or entropy, or symmetry, or some such archetype to ground a “theory of everything”. But the yogis **discovered** that the universe is naturally arranged such that the absolutely most general thing, pure being, becomes progressively more specific and differentiates into an infinitude of specific beings at the periphery.

Taimni spells this out in a useful way by calling it “differentiation”, with some allusion to the calculus function. He compares it to passing white light through a prism. The colors are latent, or potential in white light, but a mechanism is required to manifest them. Dispersion breaks the unified white light into its differentiated component frequencies. It is a simple metaphor but it captures the idea of going from the general to the specific, from the unified to the diverse, from the One to the Many.

Third, review Aphorism 2.19 above. Notice the last two works are “guna parvani”, meaning the “states of the gunas”. To me, this is the most remarkable aspect of the yogic cosmology: it describes dynamical patterns.



The One and The Many

Period. Nothing else. All states of consciousness, all external worlds are nothing but movement. In each state, the mind/body dichotomy is handled identically: both mind and matter are gunas. They are of the same "stuff". Therefore there is no dichotomy.

This is what I meant when I said, "The Hindu mind is literal and material in a fashion far beyond the Occidental imagination". The four states of gunas are all worlds of matter, but only the outermost is material in the sense the Western brute mind understands. The inner realms are solely mental, and in fact transition into worlds of spiritual "stuff", spiritual matter. To the yogic mind, Gods and Heavens are as material as the ground under your feet. They are all only states of gunas. It is all only movement; dynamics.

Finally, to add the cherry to the top, none of this matter matters to a yogi. The cosmology of yoga is provided by way of the instruction: "this is to be avoided". There is one state not described in the above scheme. It is not really a state. It is something altogether different, but this "thing" is the only goal of yoga. The "thing" is called **Kaivalya** and it corresponds to consciousness at the very center of the circle. Discussing Kaivalya is not a main focus of the present essay, although the concept cannot be avoided because it is the main goal of yoga. At this point it is mentioned for completeness sake. All the power, all the artha released in yoga has as its only goal Kaivalya. To the yogi, the four worlds of matter and movement is all a giant distraction. Prakriti, the gunas, the worlds of things and stuff are called Maya: The Grand Illusion. It is all "… a tale told by an idiot, full of sound and fury, signifying nothing".

BACK TO THE POINT

So now, with yogic cosmology under our belt, all the problems we have raised can be directly addressed. As we saw, yoga solves the mind-body dichotomy by formulating these as the same thing in essence as patterns of the gunas. Other problems we have raised are solved in a similarly straight-forward manner.

HOW MATH WORKS

Math works because the four worlds permeate each another. Events in one world affect events in the other worlds, in both directions. What happens in the physical world has reverberations on the deepest spiritual planes, and vice versa. Each of the four worlds are sources of vrittis, even in the waking state of vitarka and vikshepa. To the yogi the vrittis need to be silenced (yogah chitta vritti nirodhah). But to everyone else, the four worlds input vrittis into the mind. All four worlds impinge on our minds all the time, whether we are aware of the fact or not. The impact of each world on the conscious mind is, at least in part, a matter of scale with respect to intensity and frequency.

The intensity of the input affects the conscious apprehension. When we are in vitarka consciousness, it overwhelms awareness, just as during the day the sun's light overwhelms our vision and we cannot see the stars. The gunas of visea mostly drown out the gunas from the other three worlds. When we are in the dream world of avisea, it drowns out the physical world, and so on.

It is also an issue of "rate of vibration". Just as an infrared detector cannot detect x-rays, the minds of most people are tuned only to interpret the crude gunas of vitarka consciousness. They have not trained their minds to detect the much finer vibrations imparted from the three inner layers. So, although the vibrations are present, they are invisible, just as x-rays are invisible to an infrared detector, even if present.

However, in spite of the intensity and frequency issues, vrittis from the deeper worlds do come through occasionally, at least in some distorted form, into vitarka consciousness. The fact that they do explains a whole host of mental phenomena including imagination and creativity, psi and paranormal stuff, spiritual intuition, and also mathematical insight. [*In*

passing, I love the irony of explaining math and psi in the same sentence. Many people will not appreciate the irony.]

Mathematical insights are particular types of perceptions of avisea and linga breaking through into waking consciousness. These are insights that abstract specific things into general things (in some sense, the algebraic variable '*x*' is an archetype), and abstract patterns of relationship amongst the general things, as found at the linga level. Some people are more tuned to receive the subtle mental ripples generated in the mind by these worlds. When coupled with the right training of the mind, we call such people mathematicians. The vrittis from the deeper layers that enter the consciousness of mathematicians are the patterns of archetypes and their relationships. As stated, the Platonists mathematicians are correct in their supposition they perceive external objects; they just are not objects of the physical world of visea. Mathematics, as a language, is a specific form of sabda that allows an accurate expression of these patterns and relationships. Mathematics is Western civilization's version of Nada Yoga, the yoga whereby patterns in symbols match reality. Math however, lacks the auditory dimension possessed by Nada Yoga.

HOW SAMADHI WORKS

Next, we ask, how it is a yogi can get true insight about a supposedly objective thing when mediation occurs only in the mind of the yogi. The answer should now be obvious. All true insight comes only from the mind in the first place. As is well-known, the senses are generally unreliable guides to discern truth. Input from the deeper layers always accompanies sensory input. People we call "geniuses" are those with the right combination of sensory perception, and attunement to the deeper layers, and also in the right place at the right time (which is called "karma" and a topic for another long essay) to make a substantial contribution to the social activity we call science.

So, what the normal scientist does and what the yogi does are not all that different when seen from the view of yogic cosmology. Both tune into the deeper worlds and get perceptions of things at those levels, perceptions that are generalizations of the specific things experienced by vitarka sensory consciousness. However, the yogi does this with infinitely better precision. First, they are trained to do so, and second, their actions are

informed and guided by yogic cosmology. The normal scientist, even of the most genius caliber, must always fight against the resistance and noise generated by multitudes of vrittis unrelated to science reverberating in their mind.

The methods of yoga that silence the vrittis in a systematic and progressive fashion, will, to use Patanjali's term "clarify memory" so the only thought in the mind is of the desired object. Furthermore, as previously discussed, the pratyaya is stripped of sabda and jnana. When only artha remains, there is no interference, only a straight-line run to the center.

The pratyaya is found to be only some pattern of movement, pattern of gunas. This pattern is akin to a "cosmic address code" for the object as a thing in itself. Via this "address code" the yogi is able to sink to the center of consciousness and fuse with the consciousness that is the being of the object.

In our vikshepa state we cannot experience samadhi, but we can compare it to things we do experience and gain some small insight into this state of consciousness. There are two things we can compare it to: (1) mathematical insight, and (2) our own existence.

One on hand, samadhi is akin to mathematical insight in that it is a purely mental phenomenon that can reveal truth. But the svarupa of the pratyaya is more abstract, complex, and contains movement. Imagine the physical sound waves associated with a song, such as Beethoven's *Fifth Symphony*, or The Beatles' *Tomorrow Never Knows*. Then imagine you can comprehend the wave patterns of the whole song as one whole object. The time sequence would merely be cross-sections of this object. This gives some small sense of what a svarupa "looks" like.

Most important, the perception of the svarupa of the object as an external is only a phase in the process of samadhi. Ultimately, the yogi fuses with the consciousness that gives rise to the pattern. The fusion is with the subjectivity of the object: **knowing by being**. The yogi *becomes* the object, so the external complexity fades behind the subjective awareness.

In our internal subjective states we know and control what we are, without any detailed knowledge of our construction. It is like this for the yogi in samadhi. There is no yogi and there is no object, there is a fused entity that is both. The knowledge acquired is that of being the object itself. By being the object, the yogi acts as the object and the object acts as the yogi. It is as

intimate an understanding as your understanding of yourself, except orders of magnitude more clear since the exercise of separating out sabda and jnana preceded the fusion with the svarupa. There are no mistaken perceptions in samadhi, just as there is no mistake that you are you and not some other entity.

Swami J speaks to the idea that our normal waking state can be thought of as a form of samadhi:

> "**You're in samadhi right now**: This is a little hard to believe, but at the present moment you are in samadhi, and the object on which you are in samadhi is your perception of who you are, in the context of how you believe the world to be. In fact, you are pure consciousness, Self, Seer, etc., but have difficulty experiencing this because of the clouding of the mind field."

Thus, the yogi knows the svarupa by becoming the object. The yogi accesses artha by acting as the object.

WHAT ABOUT ARTHA?

Finally is the issue of power. This is the deepest and hardest to express. Artha, power, is a fact of nature at the deepest level. It is an obvious, but very mysterious and ambiguous truism, that some unbelievably extreme, perhaps incomprehensible, form of power generated the universe. The lesson of yoga is that we are directly plugged into this power. It is the same power ultimately, that wells up in the depths of our consciousness and gives light to every moment of existence and nonexistence. That we humans can arrange the thoughts in our mind in such specific ways and release power can almost be taken as empirical proof for the yogic cosmology.

Otherwise, without the yogic framework, the whole process is a complete mystery. Why would a bunch of creatures that are proportionately less than a speck of dust in the Cosmos - we humans - be able to do what we do with our minds? It simply makes no sense from any other viewpoint. We must be directly plugged into the ultimate power source that created the universe in the first place to be able to release and access such power ourselves.

This activity we call science is a set of methods to access this power in a haphazard and disorganized fashion. The activity called yoga accesses the power in a systematic and stepwise fashion. We discuss artha in more detail in Part 10.

EXISTENCE MAKES NO SENSE

After all of the above, we close out this long, second-to-the-last installment, with a commentary on the empirical mind trapped in the state of vitarka consciousness. This is the mind Kant described. This is the mind of vikshepa. It is the mind of the person who lives on the surface of life, and at the surface of their own mind. Many of these people are scientists and they chase after something they do not understand, driven blindly and unconsciously like moths to a flame, by forces they neither suspect exist nor would understand if revealed. It is a commentary on intersubjective verifiability, the only plausible philosophical foundation of science:

> "Everything in the world is a network of unintelligible relations. Things are not perceived by all in the same fashion. … The forces of distraction which constitute the individual consciousness are not of the same quality in everyone. There is a difference among individuals in their perception and thinking. … Everyone is inside the prison of his own experience and knows nothing outside his consciousness."

Krishnananda, pg. 37 The Realization of the Absolute. The title of Part 9 is also a Krishnananda quote.

PART 10: EVERYTHING IN THE WORLD IS A NETWORK OF UNINTELLIGIBLE RELATIONS

"They decided to establish an academy in Lagado to develop new theories on agriculture and construction and to initiate projects to improve the lives of the city's inhabitants..."

Summary: Part 10 closes out the essay by elaborating on the relationship between consciousness and power and discusses the opposite ways that power is used by scientists and yogis.

ARTHA REVISITED

The yogic cosmology introduced in Part 9 has a genesis story that was discussed briefly in the Prelude, where the Brahmanda Purana was quoted. According to this "creation myth" the act that created the manifested world was an event in Pure Consciousness. This event was the separation of Shiva and Shakti, or consciousness and power, as traditionally

translated. This separation forms the "cosmic observer" (Shiva) and the "cosmic observed" (Shakti or Prakriti).

Humans are considered miniature, self-similar copies of Shiva-Shakti since our existence manifests the observer/observed dualism[1]. The Hindu and yogic cosmologies project the dualism that is the core of our immediate experience on the entire structure of the universe, where "universe" is taken to mean the four worlds described in Part 9. In this regard, recall that each state of the gunas had a corresponding state of consciousness.

One could eschew the Hindu cosmology as mere anthropomorphism. However, we have repeatedly stressed the role of yoga and samadhi in Hindu thought, so one should not be so quick to project our limitations on these ideas. Whatever their source, the Hindu ideas offer a view of the genesis of the universe whereby the vast power to generate the universe comes from the disequilibrium in pure consciousness, in pure Being.

Let us consider another quote of the Hindu genesis that emphasizes the role of the gunas in the process of creation. The following is an interpretation by Dr. G.V. Tagare of the Brahmanda Purana creation story:

> "The eternal Brahman, the source of the Universe is beginningless and endless. It is the source of the beginning and the place of ultimate merging and rest (of the Universe). It is incomprehensible and beyond ***Sat*** and ***Asat.*** It pervaded the entire universe which was dark (unmanifested), as the ***gunas*** were in a state of equilibrium. At the time of creation, ***Ksetrajña*** [The Lord] presided over ***Pradhāna*** [gunas in perfect equilibrium] and agitated the ***gunas*** which thereby became uneven (due to loss of their equilibrium) and the great principle ***Mahat*** was evolved." (Bracketed comments mine)

Some interesting points are noted. Brahman is clearly defined as infinite. Further, Brahman, infinity, is beyond being (Sat) and nonbeing (Asat). This speaks to why, in Part 9, I did not include Kaivalya as a state in the 4-world Hindu cosmology. The experience of Brahman, infinity, is an

[1] This is the same idea in Christianity that we are made in God's image. It is not that God looks like our human bodies. It is that God too embodies the observer/observed dualism.

undefinable thing: beyond Being and Nonbeing. One can check out J.J. van der Leeuw's wonderful little book to get more insight about Kaivalya.

The above quote emphasizes that creation comes about from an act of disequilibrium. The three gunas, satva, rajas and tamas (presumably at the cosmic or alinga level) were in a state of equilibrium, in equal measure and perfectly balanced against each other. Then, the act of creation was to disturb the gunas.

This mechanism for the origin of the universe is particularly apropos to the physics of structure formation, a really hard topic, which is the study of how spatial and temporal structures appear in non-equilibrium systems. In comparison to all the ballyhoo about multiverses and strings in theoretical physics, issues in condensed matter physics have much more substance and relation to everyday life. The Hindu cosmology is unambiguous that non-equilibrium of dynamical systems is the basis of all manifestation.

SHIVA-SHAKTI: THE COSMIC OBSERVER AND OBSERVED

To understand what caused the disturbance of the gunas, we turn again to I.K. Taimni, this time from his opus "Man, God and the Universe", where he describes the initial "creation of something out of nothing". The first thing to manifest is called the Shiva-Shakti Tattva.

> "The Ultimate Reality…is a state of perfect equilibrium and balance. We know that when we want to disturb such a state we have to use force and the more stable the equilibrium the greater the force required for the purpose. But once this state has been disturbed, energy becomes available for work in the scientific sense of the term until the equilibrium is restored. … we see that the power needed for the universe must come from a self-initiated action of Cosmic Consciousness which by drawing apart the two poles from the one static Centre by the force of Divine Will creates the unlimited amount of power needed for the purpose. The potential power thus available can then be transformed and stepped down to lower levels through different kinds of spiritual, mental and material mechanisms, just as electrical energy generated at very high

> voltages in hydro-electric system is transformed into currents of lower voltages by transformers for ordinary use."

This quote implies additional ideas not yet discussed in the essay that are now briefly presented. We saw that it is axiomatic to the Hindu mind that being = consciousness. We also know that the goal of samadhi is to experience perfectly undisturbed consciousness, and therefore, pure Being. It is this pure Being Taimni calls "Ultimate Reality", but it is also called Brahman, and to the Western mind, infinity. In the diagram of the 4 worlds presented in Part 9, Brahman, infinity, is the point at the center of the circle.

It is interesting how the Hindu thinks of infinity. It is a state of perfect balance that is easily explained using the number line of integers:

$$-\infty\ldots-3, -2, -1, 0, 1, 2, 3\ldots\infty$$

If one were to sum the entire integer number line (or the real number line for that matter), it would equal zero. Everything would perfectly cancel. This is the Hindu concept of Brahman, or infinity, which contains everything within it in a potential state. It appears to be zero, but has within it everything. This also helps us understand the Hindu idea of "unmanifest" which refers to this condition. This is the condition of perfect equilibrium that precedes the advent of the Shiva-Shakti Tattva.

WAKING UP TO A BAD DREAM

The act of creation, the Shiva-Shakti Tattva, the disturbance in pure Being, is something like waking up. When we wake up, the first thing that happens is we become aware of ourselves. This act precedes any other mental event, after which perceptions, memories, or goals flood into awareness. In some extremely abstract sense, the creation of existence is analogous. The perfectly balanced infinity becomes aware of itself. Why this is so, how it happens, are beyond human comprehension in the vitarka state. You have to experience Kaivalya to understand the "why" of the whole process.

But this act of self-awareness becomes a state of disequilibrium in the perfect infinite balance, a loss of perfect equipoise. This is the disturbance that creates existence. Since the underlying substrate is infinite, the

"force" this self-awareness can potentially generate is unlimited. It is this act, event, whatever you wish to call it, that is the act that sets the gunas in motion. In this context, the gunas are analogous to the numbers on the number line. The gunas are the infinite possibilities contained in the infinite Being.

The "waking up" of infinity has two faces. One face is the awareness, the consciousness that is the very property of being. This face is called Shiva. The other face is the infinite possibilities contained in being, which is called Shakti. Thus, is born the observer/observed dualism at a cosmic level. Shiva is the meta-consciousness of all conscious beings that will exist. Shakti is all possible observed states: all possible material universes in all grades across the four worlds. Shakti is the mother of Nature, the source of Prakriti, the grandmother of the gunas.

Then, as Taimni says, the separation of observer/observed, Shiva/Shakti creates a potential well. The energy of this potential leads to the generation of the four worlds in a fashion akin to a step-down transformer, where the power is distributed in the generation of the four worlds. The processes generating the four worlds are obviously cosmic in scope but share features with physical processes like dispersion, diffraction and phase transformations, but to go into more detail will have to wait for another essay.

And here and now, we exist on the fringes, the periphery, of this whole enormous incomprehensible process that is the cosmos: small, small little creatures powered by some infinitesimal sliver of an enormous energy.

One final point to round out the story: The waking up of pure Being that generates the manifested universe will be followed in some 300 trillion years by the going to sleep of pure Being. This 300 trillion year cycle repeats endlessly, forever and ever and ever and ever…

For the hard noses out there that want a prediction if we are to consider Hinduism as a form of science, the Hindu account of the creation of the universe clearly implies our Universe has finite energy. Recall Bharkara's quote:

> "In this quantity consisting of that which has zero for its divisor, there is no alteration, though many may be inserted or extracted; as no change takes place in the infinite and immutable God when worlds are created or destroyed,

> though numerous orders of beings are absorbed or put forth."

"Numerous orders of beings" is presumably a finite quantity; large beyond comprehension, perhaps, but finite nonetheless. That's the funny thing about infinity: any finite quantity is irrelevant in comparison.

ALL PLUGGED IN AND NO PLACE TO GO

The Hindu cosmology makes a direct bee-line from the most abstract cosmic event, the creation of manifestation, to our immediate existence. Our very awareness is an infinitesimal quantum (a "monad") of the exact same awareness that awoke at the moment of creation. Our material being, on all four worlds, is constructed from the same gunas set into play at that moment.

It is this direct link, connection, whatever you wish to call it, that allows our minds to be plugged into the vast power that underlies the universe. Of course, there are many intervening levels between our physical/vitarka consciousness and the cosmic levels described in Hindu cosmology. But the connection is there and we can tap that power through correct knowledge.

This is what science is: it is a set of processes that are able to tap this power by having correct knowledge. As explained previously, correct knowledge is defined as having the dynamics of our thoughts match the dynamics of some natural system. The resonance so created is a pale facsimile of the fusion of observer and observed that occurs in samadhi. The result, nonetheless, is the release of some degree of power. Again, sunlight versus laser beams. The power itself comes from the link between our puny physical being and the great cosmic Being that is the source of all things.

However, Western science does not know of the Hindu ideas. Western science is arrogant and self-confident, like a teenager, and wants go it on its own. The result of going it on its own, however, is that modern science is confused on all fronts: about what the mind is, about how the senses link to the mind and the objects of perception, about what math is and why it works to describe nature, and about why correct knowledge releases power in the universe.

Again I ask: who looks the barbarian in this picture?

WITH GREAT POWER COMES GREAT RESPONSIBILITY

Correct knowledge releases power. The deeper issues are: why is the power being released? To what end is it used? What is the quality of the knower and the knowledge that is releasing the power? All of these have direct bearing on the fruits one shall reap from their labors.

The fusion attained in samadhi releases power in the form of the siddhis. However, the very nature of yoga precludes the use of siddhis in the worlds of the gunas. Instead, yoga goes for the "big money". Yoga seeks nothing less than infinity. The goal of yoga is to experience the actual infinity that is consciousness per se. There is no comparison between the experience of the actual infinity of consciousness and any relative experience.

Experience in the four worlds is always of a relative nature, always that of limitation and conditioned-ness. Recall Krishnananda's quote:

> "…as long as we are in a world of relativity where everything is determined by everything else…nothing can be known absolutely…we cannot know anything unless we know all things."

This insight really needs to be driven home. If we accept that existence in space and time is of a relative nature, then the above conclusion is inescapable. It is a logical deduction no different in form than 1 + 1 = 2. It is delusion and ignorance that prevents people from putting this fact before all others in regards to our corporeal existence. Any relative being implies the entirety of the universe, is dependent upon the entirety of the universe.

We cannot live by "to a first approximation…" forever. By which I mean that, to a first approximation, we can think of systems in nature as isolated. First approximations may have a limited operational utility, but at the intellectual level we are presently engaged, such sloppy thinking is not allowed. There is no isolated system in nature, not even the whole universe, as is believed currently in physics (the whole universe is dependent upon the unmanifest).

Because the relative is, by definition, that which depends on all other things for its own definition, there can be no freedom for any relative thing. The form of any relative being is conditioned by all other existing forms. The very idea of freedom in corporeal existence is delusional. The concept of

freedom is very much like the concept of randomness: neither can even be defined. If one tries to define either, the very definition cages the thing being defined. If something is truly free, it is unlimited in every possible sense. Western people have stupid ideas about "freedom". The concept of freedom has the same form as the statement "sound of one hand clapping". It is simply an absurdity to use the concept of freedom as if one knows what they are talking about[2].

From the yogic point of view, all relative things are a form of bondage, no matter how seemingly glorious and expansive they may appear relative to our human vantage point in vitarka consciousness.

On the other hand, there is only one Infinite. There is only one Absolute. This Absolute is pure consciousness. Since there is only one instance of it, it is completely free. There is nothing outside of it or next to it to provide any limit on its Being. The Absolute, Brahman, infinity, is the only free thing that exists. But it is not really a "thing". It is. It is Being.

Being, Infinity, Consciousness, One, Absolute are all synonyms. Becoming, relative-ness, limitation, incompleteness, multiplicity, change, diversity, creature-hood, experience: these too are all synonyms. The Absolute is the goal of yoga. Anything else is just more of the same: limitation, change, incompleteness.

Therefore, any relative experience is downplayed in yoga as merely a stepping stone, and warned as a possible temptation that will divert the yogi from the main goal of fusion with infinity. In yoga, performing samadhi on relative objects (sabija samadhi) is akin to "training wheels". Sabija samadhi are just exercises to strengthen the yogi's ability to perform samadhi in preparation for the ultimate fusion of consciousness with itself (nirbija samadhi).

Hence, yoga does not try to control the universe in any way via the siddhis.

[2] Not to go into a dissertation about freedom, but I don't want it to seem as if I am against "freedom and liberty" with my comments above. There is an impulse behind the Western desires for and notions of freedom and liberty. The urge for freedom is the urge for unity of Being. Both Krishnananda and van der Leeuw (see Chapter 8) discuss where the urge for "freedom" fits in, and it is useful to learn their ideas. The surface idea of freedom does not at all resemble the very real and deep cosmic urge that underlies it.

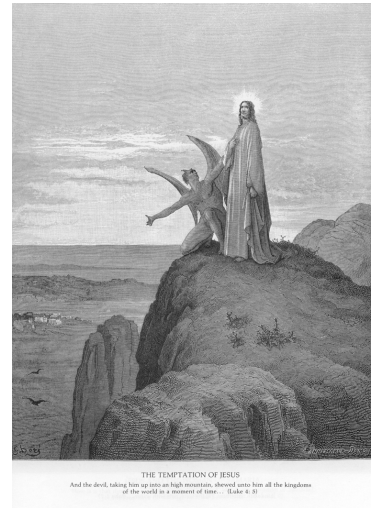
It is not a moral decision that drives yogic practices to this conclusion. It stems from a technical understanding of how energy and information flow in the realm of relative-ness, in the realm of the gunas. The term "karma" is much bandied about in the West, but it is a technical term in yoga, much the same as "work" is a technical term in physics. Karma, at its most basic, is a generalization of Newton's third law that for any action there is an opposite and equal reaction. This principle holds, according to yogic experience, at all levels of relative-ness, in all of the four worlds, and not only with respect to relatively insentient matter in the physical universe.

Because all relative things are connected in a vast incomprehensible network, a change at any point will ripple through all existence and generate a back-reaction effect called karma. No matter how seemingly small, the effect will feedback on the yogi and thereby impart vrittis into consciousness. Any vritti, no matter how small or seemingly insignificant, will prevent the ultimate goal. The nirodhah condition either is or isn't. There are no shades of grey. Therefore, it is logical and methodological necessity that yogis do not use power to affect the manifested worlds.

Any artha released in the run-up to the final goal is only a stepping stone to the final goal. Artha released in samadhi is used only to move deeper into consciousness, to climb back up the potential well, to return to the state of equilibrium.

Yoga has no interest in changing or controlling the physical universe. Any attempt to do so will bind the yogi and prevent further progress. Even Jesus was smart enough to figure this out. But modern science has no interest in this way of thinking.

Therefore, in spite of its fantastically complex and complete understanding of the nature of the Universe, of mind and matter, of the hidden worlds of nature, yoga will never seek to control, manipulate or exploit the various arthas discovered along the path to the final fusion, Kaivalya.



Jesus wasn't tempted by things and stuff

Science lacks any framework to understand the relationship between consciousness, mind, and externals, other than burying its head in the sand and proceeding as if the problems don't exist. Thus, the intellect conditioned by modern science stumbles like a blind man through mysteries that would paralyze the mind with breathtaking awe if they were even glimpsed.

The few great mysteries science has tapped into, it understands like a blind man feeling his way through a room full of objects, like blind sages feeling the different parts of the elephant. There is no perspective, no context.

Driven by the haughty egos of sensory-bound intellects, modern science is ignorant of the true nature of the forces it unleashes into consciousness. Where the yogi treads with infinite subtlety to avoid disturbing the forces of the universe and prevent the ripples of karma, science blindly rushes in whipping up a frenzy of energies. The result is samsara: the eternal wheel goes round and round, round and round, round and round…

CONCLUSION

Finally, we come to the end of this essay. Normally, as a scientist myself, I would write a bullet point summary of the main points covered in this essay. However, I will not do that. Instead, we can summarize rather succinctly using the classical calculus idea of integration.

If we integrate over historical time, all the efforts of all those who have sought to understand the profound mysteries of our existence here in Western cultures, we get a value that is a reflection of modern Western scientific knowledge. Compared to the Hindu ideas and methods we have used as a contrast agent, it would be a small value indeed. Science, as a social practice in the West, is an extremely dilute form of samadhi that requires the consciousness of thousands of individuals, integrated over long periods of time (long relative to a single human life), to produce the effects we have learned to date.

We do not know about the yogis. They keep to themselves. All I know is I have had some of the more elementary experiences that they teach. I then infer that the more advanced practices will work as advertised. This is analogous to when I was a freshman undergraduate. Although I knew

nothing of advanced molecular biology, other than that it existed, I was confident that if I proceeded step-wise, I would eventually learn the advanced stuff. And that has come to pass, and is now how I earn my paycheck. I have no reason to think it will be different with the yogic methods and techniques. Therefore, I have no problem using their ideas as intellectual fodder to construct the arguments put forth here. From my limited experiences in altered states, I know that the yogis are more correct about the nature of the world than the scientists.

Be that as it may, what is common to yoga and science is the process of concentrating consciousness to release the artha of some aspect of reality. In the case of the science, enough concentration has occurred over time spans of millennia, and involved countless individuals weakly concentrating their minds while in the vikshepa state. The effort of science is simply inefficient compared to the yogic method of samadhi.

By seeking to understand the nature of the mind, and how reality appears in the mind, the yogis took the more efficient path to understanding. By refusing to accept the depths of human consciousness, and confine itself to the superficial levels of the sensory-conditioned intellectual realm, science has imprisoned itself in an inefficient means to understand truth.

The main point of this article is to recognize that science is indeed tapping the same processes tapped in yoga. When we ask the question: what is science? We can answer by saying it is an extremely diluted form of samadhi. It is an inefficient form of samadhi, haphazardly discovered over centuries. The result is an arbitrary, confused, and ill-founded understanding that, however, is effective enough to release power into the universe and into consciousness. We end with two clichés that serve to capture modern science as a form of samadhi:

The blind leading the blind…

A little bit of knowledge is a dangerous thing…

EPILOGUE

"He has been eight years upon a project for extracting sunbeams out of cucumbers, which were to be put in phials hermetically sealed, and let out to warm the air in raw inclement summers. He told me, he did not doubt, that, in eight years more, he should be able to supply the governor's gardens with sunshine, at a reasonable rate."

–Johnathon Swift

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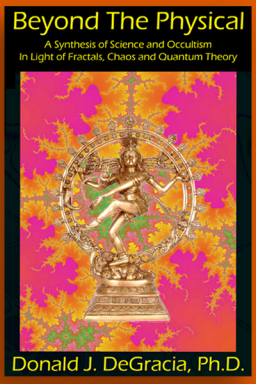
"He had been eight years upon a project for extracting sunbeams

What is Science?

In spite of the amazing technological marvels of the modern world that have stemmed from science, there is no agreed upon definition of what science is. In this lively, colorful, and engaging work, Don DeGracia contends that science is a very weak form of what has been described for thousands of years in Hindu India as “samadhi”. Samadhi is an advanced technique of Raja Yoga in which the meditating subject fuses with the object of meditation, in a process that has been called “knowing by being”.

By understanding science as a weak form of samadhi and comparing it to the knowledge aquired from yogic practices, many of the limitations of science are brought to the fore. These include: the link between mind and body, the role of the senses as middle-men between the mind and the objects of perception, why mathematics is "unreasonably effective" for describing the physical world, and how and why power is unlocked by the human mind when correct knowledge is obtained.

What is Science? is controversial, informative, sometimes witty, and sometimes irreverent. This newest work from Don DeGracia is certain to please those who are inclined to open-minded debate and consideration. The book will very likely be ignored by hard-core materialists who are too arrogant to care. If, by any chance, a materialist takes some of his precious time to read this little book, they will likely be pissed off. But oh well, such is life. Only God can please everybody all of the time.



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