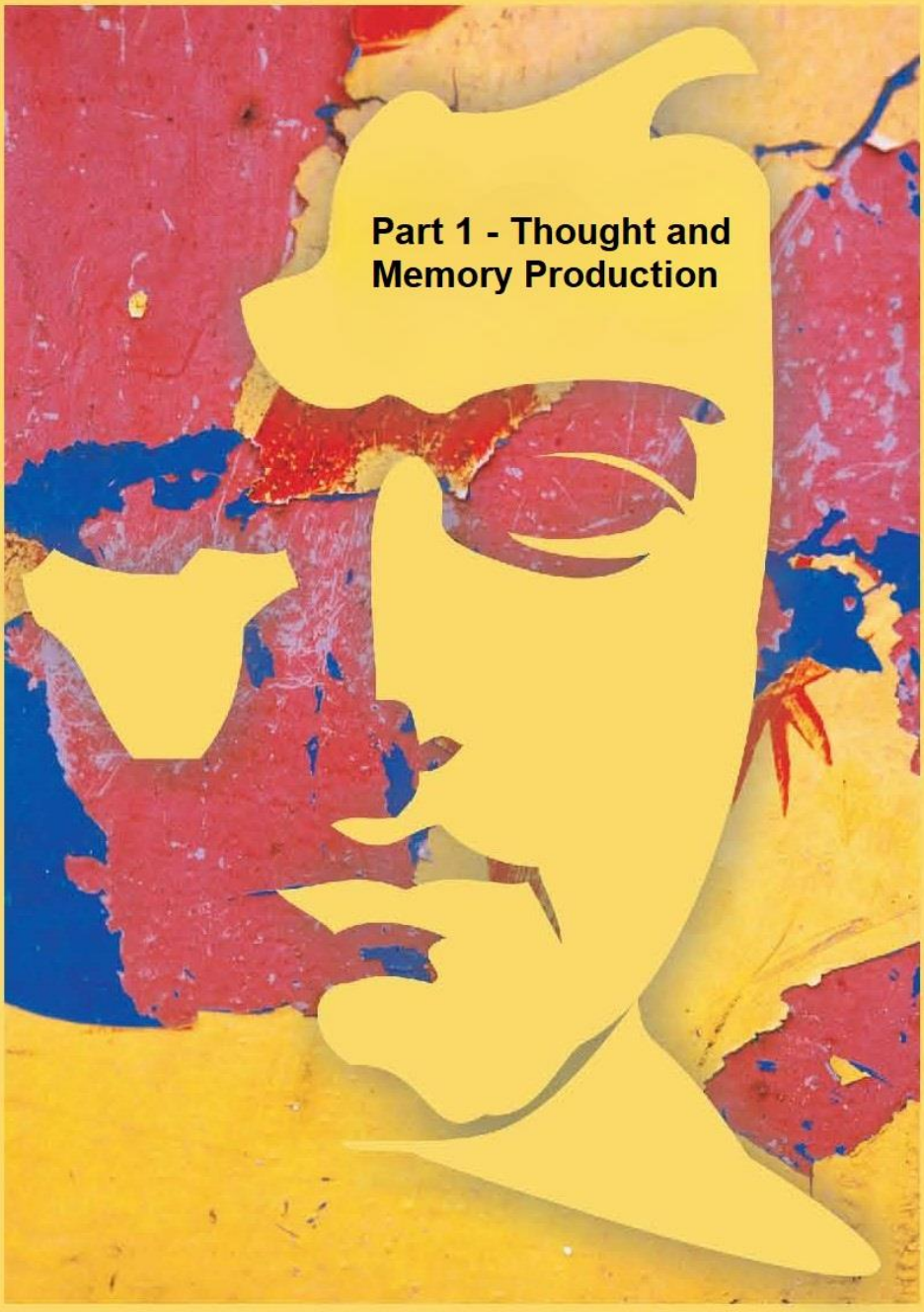
Nature of Human Thought



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Nature of Human Thought (revised) - Part 1

Thought and Memory Production

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Introduction

In 2004 I wrote my first book entitled "Nature of Human Thought". In it and in subsequent edition I tried to cover some ideas on how thought is formed and transmitted. The ideas were speculative in nature, but I tried my best, with the knowledge available at that time, to explain the mechanism of how thought could be formed in the brain and transmitted. The basic framework was explained but the details were missing.

Since then, I have thought a little more about the subject and I present in this booklet a possible mechanism on neurobiological basis of thought production and memory formation (Part 1; this essay). And furthermore, a mechanism on how it is transmitted and its interaction with matter and gravity (Part 2). I also speculate on the unexplored possibilities which might provide a detailed mathematical foundation of the nature of individual thought.

(A) Thought Production

Almost all of us, sometime or the other in our life, have gone through the experience of feeling that somebody is following or watching us. Whether it is a human being or an animal it makes us turn our neck to see what it is and investigate. Similarly, there have been innumerable instances where people and animals have sensed danger much before it strikes them. What is the nature of the signal that tells our mind that somebody is watching us intently or there is a lurking danger and how is that signal generated and

sent from the pursuer's brain? In other words what is thought and how is it generated and transmitted?

Since time immemorial mankind has thought, discussed and written about the origin of human thought. Religious writings are basically a discussion on it. Perhaps the greatest treatise on it has been Patanjali's Yoga Darshan, which to my mind is still one of the most definitive and scientific writings on the control of human thought. Patanjali's book is the oldest book on Yoga. It is believed that he wrote his book some time in 300 BC or even earlier though there is still dispute about the date. Patanjali defines Yoga as control of thought waves. This is probably the first definition of Yoga. He then describes how through Yoga, one can produce concentration and how this concentrated thought can be used to gain physical and spiritual powers for a person's ultimate enlightenment.

Interestingly enough sage Patanjali does not address the central question of how the thought originates and what is the nature of its generation but gives details on how to control it for achieving mastery over natural forces. However recent developments in brain research make it possible to understand thought, mind and consciousness.

Generally human thought has been considered by philosophers, religious leaders etc. as non-material in nature. However, a result (thought) produced by a physical brain has to be physical in nature and should be governed by physical laws. I will attempt to throw light on what these laws could be. Most of the concepts presented here are intuitive in nature with very little mathematical formulation.

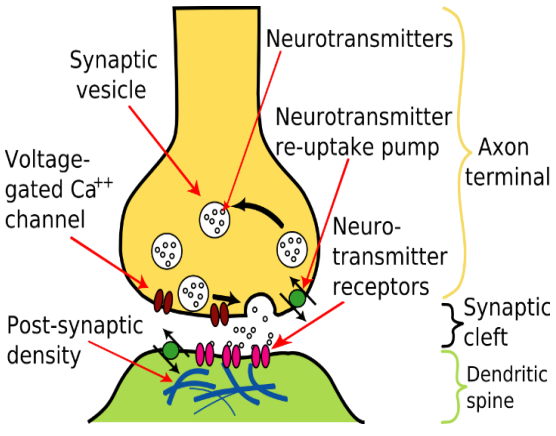
Scientists have conducted many studies all over the world to find out how the brain works. Magnetic resonance imaging (MRI) techniques, which are non-invasive in nature, are normally used in mapping the brain. Recently scientists have started using functional MRI (fMRI) for sharper images. Thus, fMRI scans are taken of the brain under different stimuli which show

up on the computer screen as maps of blood flow in the brain. Scientists say that the place of maximum blood flow is the area where thought of a particular nature is generated. Yet no mechanism has been put forward on how thought is produced.

Human Thought Production

It is an accepted fact that a thought is produced when brain neurons fire. There are close to 80-100 billion neurons in the brain (the exact figure is not known). For a simple thought like what is the colour of a flower, form of a cat or dog, etc. a small portion of the neurons fire but in deep concentration leading to *Samadhi* and *Sanyam* (combination of concentration and contemplation on a single subject or an object for a long time) almost all the neurons fire to produce a deep thought. Thus, the difference between deep and shallow thought is its intensity and duration.

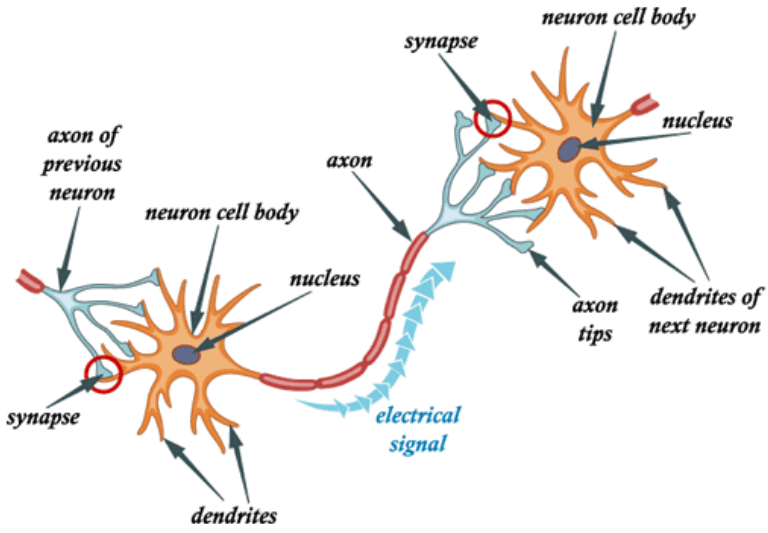
When neurons fire, they communicate with each other by forming neural pathways. Activation of neural pathways in turn triggers firing of neurons. This activation is triggered either by signals from sense organs or stimulation of certain memory space in the brain. Firing neurons help them to communicate with each other. During this communication electrical signal from a neuron is converted into chemicals (neurotransmitters) and transmitted across the synaptic cleft to another neuron where it is again converted to electrical signal for the onward journey.



Synaptic cleft is a tiny space of about 20 nanometers (nm) between an axon and a dendrite and is the place where two neurons exchange information via neurotransmitters (NT).

A neuron has three parts. At one end is dendrite which accepts NT from other neurons; the central nucleus which is the heart of neuron and a long

nerve fiber called axon whose end (synapse) releases the NT for transmitting to another neuron. *A large number of neurons connected like this forms a neural pathway.*



Why did nature produce this type of diode-based communication system where the electrical signal from the neuron is first converted into chemicals (neurotransmitters), and transmitted through synaptic cleft and again converted back into the electrical signal in the next neuron?

A possible answer could be that during this conversion in synaptic cleft, weak biophotons are produced which are the signature of thought. Anytime a chemical reaction takes place (production of NTs and their acceptance in NT receptors are such reactions) it produces weak photons. *This is the nature of the chemical bond.*

Weak photon production was experimentally observed in the brain in the late 2010s when scientists detected them being emitted during the firing of the neurons and transfer of neurotransmitters across the synaptic cleft. Scientists are still not sure in what way brain uses these photons but speculate that somehow, they may help in increasing communication between various parts of the brain.

The weak photons produced have broad spectrum in the range of 200-950 nm though we are not yet sure what is the peak of the emission. In this range the cerebrospinal fluid in the brain (which is 99% water) is nearly transparent. Thus, the biophotons can easily communicate with each other.

I conjecture that these photons from large number of neural pathways synchronize via a non-linear process to form a three-dimensional hologram which we can call a thought. Hence the origin of thought probably occurs in synaptic clefts!

Each thought, however, is the result of activation of a unique set of neural pathways though we still do not know how many neural pathways are needed for it. ***In fact, the formation of such unique neural pathways is the memory***. *So neural pathways are the memory and neurons firing in these pathways produces a thought.* With practice and constant flow of electrical signals through these neural pathways, memory of that particular object gets strengthened.

But how do the photons from millions of synapses synchronize and form a coherent thought? For that we will have to examine the brain complexity, understand large number mathematics and possible synchronization mechanism.

Brain Complexity and Synchronization of Thought Photons

Just to give a sense of complexity of brain let us look at the numbers of possible neural pathways in the brain. There are close to 80-100 billion neurons in the brain. Each neuron has many dendrites and axons which connect it to other neurons. Recent scientific evidence also suggests that besides neurons another type of cells called glial cells also take part in communication.

Glial cells outnumber neurons by nine to one and can modify the signals transmitted by each neuron. There are therefore estimates that 10^{15} synapses in the brain maybe involved in communication. Thus, the number of different combinations for neural pathways and thought production are mind-boggling. That is the reason why the human mind can generate millions and zillions of thoughts!

However, the photons from each synapse must be synchronized with others to produce a stable thought structure. This synchronization takes place via the positive feedback type mechanism so that each photon is influenced by others and is guided by an entity called 'I' (ego, will, sense of identity, etc.). This is similar to the mechanism where fireflies in large numbers synchronize their firing.

Ego acts like a symphony director and helps provide the necessary energy and focus to maintain a given thought for a certain time. It also constantly compares it with signals from outside (those we receive through the senses) to give us a sense of reality.

We still do not completely understand how ego, or 'I' can influence this process, but just like the music conductor who determines which part of the orchestra plays for how long, 'I' decides how long a particular thought will remain in the "vision" field. *This process is called concentration and seems to also exist in other animals.*

With practice, concentration becomes strong till a person can nearly make all the 80-100 billion neurons fire in a laser-like fashion for a long time on a single thought. This is the genesis of meditation or *Samadhi* and results in *Sanyam* according to Sage Patanjali. According to him *Sanyam*, done on any subject results in its complete knowledge. This is also the basis by which all great discoveries in science, art, and any other human endeavor are made.

This deep thought produced continuously also helps dissolve memory knots of *the brain* since this activity requires increased number of neural pathways and hence the loosening of existing memories. Patanjali says that removing of memory knots or *sanskars* makes the mind like a crystal so that any object or subject occupies the whole brain. Or in other words when memory knots are resolved the processing power of the brain increases exponentially and allows the brain to focus on a single object or subject in a laser-like manner. Hence the reference to crystal-like clarity of the brain.

The production of weak photons for thought formation could also be the reason why many Yogis have experienced seeing white light during intense meditation. Similarly the observation of white light by persons during near death experience (NDE) could be an outcome of nearly all the brain neurons firing during the final exit.

Unexplored Possibilities

Here are some of the unexplored and speculative possibilities which can give a mathematical formulation of thought production.

1. We still do not know how many Neurotransmitters (NTs) are released per firing of neuron.
2. There are speculations that it is anywhere between 2 and 20.
3. Also, the molecular structure of each NT and receptor is not fully understood.
4. Besides how many of these NTs are captured by receptors of the next neuron is also not known?
5. The problem is compounded by the fact that we do not have the technology to see real time happenings in the synapse.
6. If we can find the number of NTs released and their capture by receptors then the energy and frequency of biophotons can be calculated and a possible hologram could be created from this data.
7. That will be the first attempt on calculating the structure of a single thought!

(B) Memory Production and Removal

We are defined by our memories. They are the only things we can call our own. All our experiences, ego, I, and our existence is the sum and substance of our memories. They guide us on our future journey in life and till the end of our existence those memories are with us.

Most of our memories can be divided into pleasant and unpleasant ones. These memories give rise to a whole range of emotions – love, hatred, jealousy, fear, happiness etc. To live a good and happy life we should strive to have mostly pleasant memories and see how the unpleasant ones can be reduced or removed. One of the main tenets of Indian *Yogic* system is complete removal of our memories at the time of final exit so that we are liberated from the cycle of birth and death.

But what are memories; and where in the brain they reside; how are they formed; and what is the possible mechanism of their removal? We will try to explore and explain these issues based on the material presented in the **Section A.**

Previous research

Memory, its origin, and spatial location in the brain has been researched for hundreds of years. Extensive literature on it exists and hence this article is not a place to write the history of memory research, but we will briefly touch the salient features of previous research. One of the seminal works on memory was done by Eric Kandel who got the 2000 Nobel Prize for his work on this subject. Kandel's main discovery was that synapse plays an important role in memory formation and the consolidation of memory changes the synapse itself. Though this pioneering work on neurobiological basis of memory showed the process of memory formation and consolidation in few neurons but it did not show where the memory is located and how is it related to consciousness.

At the same time the existing theories on neurological basis of memory formation also do not explain the pliability and plasticity of neurons and neural networks. Scientists have recently found that with time the original neural networks shift spatially and yet are able to retain the same memory. How this happens is still a mystery and thus we do not know where the memory exists and exactly what it is.

Memory formation

As we saw in **Section A** memories are nothing else but the arrangement of neural pathways and the sequence of their firing. Neural pathways are made the moment brain starts forming in the womb. Very rudimentary memory of movement, swallowing, etc. starts in the second and third trimester of pregnancy. Prenatal memory starts forming around 30 weeks after conception. After this time, the fetus is affected by the food the mother consumes. A fair amount of good data exists on how alcohol and drug use by mothers at this stage affect the children later in life.

The moment a child is born there is an explosion in memory formation. A child's brain is like a sponge for information intake since neural pathways must be established. So, the sound, smell and other sensory organs start sending signals to the brain for the formation of neural pathways.

However, the first solid memories are those when eyes start focusing. The input signals from the eyes are coordinated with those from the ears and help stimulate the neural pathways which results in the formation of a random thought hologram. *This hologram is compared with the actual object and, when after many comparisons the exact match takes place, then the memory is etched in the brain.*

The "comparer" of reality and hologram in this case is the nascent ego of the child which is still developing but is not strong enough to focus on a particular thing for a long time. This results in memories being formed and

forgotten. Though the brain at this age is like a sponge for absorbing information, the lack of focus does not allow the memories to become strong.

This is the reason why children have very few memories till the age of 2-3 years. With the developing of ego as we age, longer focus results and hence a stronger memory. The memory is further strengthened when the child repeatedly performs the process of seeing, validating, and memorizing. This also helps in making neural pathways stronger when the child repeatedly produces the thought hologram of a given object.

Children are therefore particularly good at doing mundane things repeatedly because this is how they set up and consolidate their memories. Since the brain is virgin in childhood, those repeated early neural pathways are strong and thus some of the childhood memories (after the age of 3-4 years) are very powerful.

Many times, the parents get exasperated with a child repeatedly performing these mundane actions and scold the child. This should not be done because scolding creates fear-complex memories, and the new learning is retarded.

As we grow older this process of memory formation and consolidation is repeated and a whole network of neural pathways is formed. The sum and substance of our experiences and memories give rise to our sense of self and is the genesis of ego.

If the memory is not strengthened by repeated experiences, then those neural pathways are used for something else and hence the memory becomes weak and maybe lost as happens in children till the age of 2-3 years.

Therefore chanting, rote learning and associating the images with signposts, etc. are ways of strengthening the memory. However, there are some people

who possess photographic memory. They can immediately remember most of the details the moment they become aware of it. This happens because their brain possesses superior processing power and is mostly inborn and may have a genetic element to it.

Our memory formation is based on a sequence of events and hence the time is embedded in the memories. They are replayed as a movie and thus the sequence of events tells us about the passage of time. This is the genesis of time perception.

Since the neural pathways are formed sequentially, hence during recall, one set of neural pathways triggers another set. It is therefore quite possible that the *neural pathways of such events may reside close to each other in the brain otherwise sequencing may be difficult.* This triggering of sets of neural pathways is probably facilitated by the ego. When ego becomes weak the triggering is reduced, and the sequencing is lost. This happens temporarily during dreaming; and permanently in dementia, Alzheimer's disease, and other brain maladies.

Memory Removal

In everybody's life there are both painful and happy memories. It will be wonderful if somehow, we can get the ability to remove those painful memories. Then we all can have a better and happier life with pleasant memories. Most people think that if we do not think about the painful memories then they are gone. But painful memories produce strong psychological knots which remain buried in the brain. When by some trigger they get reactivated, the pain comes back again. To remove the pain a mechanism of actively removing such memories is necessary.

A possible mechanism of memory removal is to focus on a single thought for an exceptionally long time. It is called *Sanyam in Patanjali Yoga Sutras.* Production of *Sanyam* requires large number of neural pathways since huge processing power is needed. This may help in the removal of the other

memories since those neural pathways are used for this particular thought. With discipline, willpower, and time the brain can become very pliable so that *Sanyam* results effortlessly.

As Patanjali says in his *yoga darshan*; "*When a brain becomes powerful and nimble it is like a pure crystal which takes the color and shape of the object which comes in its view*". Such a brain is therefore able to focus like a laser on anything that occupies its vision field.

This process has also been corroborated by recent work in memory formation where scientists have shown that by thinking deeply on certain object the synapses are weakened for a short time. They can then be modified to form pathways for other memories.

Memory removal is the most important aspect of Indian *Yogic* system which asserts that this leads to liberation from the cycle of death and rebirth. Also, with less memory attached to our soul during the final exit, we can tunnel through the drag of gravity and other souls and reach the other worlds. *This is the easiest way to get out of the earth's gravity field!*

Memory removal also helps in unraveling of memory knots, mostly made of emotional incidents, and helps in resolving emotional conflicts. There are many instances where the resolution of such conflicts helped people die peacefully. Another way to remove unpleasant memories is to cultivate the habit of continuously thinking about the pleasant incidences that have happened in our lives. It is a difficult process but tried regularly could help in resolving unhappy memories.

Many times, it happens that our PC's, laptops, and other computing devices become slow since they are cluttered with folders and other materials which take up working memory space. After downloading most of the information on an external hard disk, the memory of the PC is restored, and it functions

faster and smoothly. In the same way uncluttering of the brain (by removing the psychological memory knots) will allow it to function properly and faster.

Nevertheless, there are other powerful and intense memories which are the result of emotional and painful episodes. These episodes, when they occur, result in occupying the whole brain so that the focus of the brain is single pointed. It is almost like a *Samadhi.* These memories are very difficult to erase but necessary to be removed for a happy life.

Can Memories Exist Outside the Human Brain?

It is possible that powerful emotional memories can form a very deep thought resulting in a stable soliton and can exist for a long time. I conjecture that such stable memories may reside in Knowledge Space (KS). Knowledge space could be equivalent to external hard disk where our strongest memories get stored automatically.

I define Knowledge space (KS) as a space which may contain information structures or memories which are very stable and will remain there for a very long time. This is similar to cloud storage. However, cloud storage is connected to our devices via cables and processors. Whereas the KS maybe tethered to our gravitational field. How memories can go and reside in KS is discussed in Part 2 (transmission of thought and its interaction with matter).

This knowledge space may also contain fundamental knowledge produced in the past and is continuously fed by the ever-increasing knowledge from various civilizations as earth travels around the Milky Way Galaxy. A prepared and focused human mind can access knowledge from this space, and I feel that great discoveries of mankind have come from such access.

There are indications that strong emotional memories maybe attached to inanimate objects. There is a good amount of data from all over the world where the mediums have been able to access the memories from such

objects and it has resulted in new finds of buried ancient structures (almost 15-20,000 years old); ability to tell sequence of events about unnatural deaths; and timelines of civilizations long gone and lost.

It seems that the physical objects (like a stone, bone or any other object used by the people long dead) are somehow attached to the memories of those persons in KS and the mediums are able to access them. In scientific language this ability is called "Intuitive Archeology".

Such ability to recall the memories or past events of people by simply touching them was shown by Swami Vivekananda – the Indian spiritual leader. This ability is also mentioned in Patanjali Yoga Darshan; *"By doing Sanyam on other person's mind, a Yogi gets the knowledge of that person's thought waves but not the contents of his mind".*

It is also possible that KS may have templates of various life forms. The memories of life forms remain in KS because these forms existed for an exceedingly long time (couple of million years). Thus, either a deep thought for a long time or "nearly constant" life forms for a long time produce these stable memories in KS. Even if the physical form disintegrates the ghost or memories remain in KS. This memory of forms or templates maybe the basis (besides the regular evolutionary forces) of new life forms for a young life-sustaining planet as it comes across KS in its journey through space.

We can also conjecture that the transfer of memories to KS from our brain is via a filter. Thus only deep emotional memories get transferred and mundane memories remain behind in the brain. This process helps to reduce the loading of KS. The mundane memories however need to be removed via the memory removal process outlined in the previous section.

Complete Trace Removal

In the modern internet and world wide web if we want to completely remove our trace then not only, we need to format our PCs, but also remove all the

information from the net. This is not easy since the deep web contains the archived material with which we have been associated, and it is exceedingly difficult to remove all of it. Thus, somehow and somewhere the past can catch up with us!

So, we need to remove memories from the brain and those from KS to get complete liberation from the cycle of birth and death. Just like the hard disk can be formatted or cleaned when it is attached to the PC or a similar device, similarly the cleaning of memories in KS can only be done by intense thinking via the human brain. And as Patanjali says in his *Yoga Darshan*, *"When the mutations of gunas cease to function, flow of time stops and Kaivalya (Nirvana) results".* This results in complete removal of trace memories and liberation of yogi.

Otherwise, the traces of our memories in KS force our rebirth either here on this planet or other planets. This could probably be the genesis of *Karma* concept so often mentioned in Indian philosophy.

Suggested Reading

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