

THE DOUBLE-SLIT EXPERIMENT

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Feynman has also pointed out that the entire mystery of Quantum Mechanics is in the double-slit experiment. That is what makes it so very interesting. From the standpoint of common sense, as Feynman himself has pointed out, the behavior of Nature is absurd. And this absurdity is nowhere more obvious than in the double-slit experiment. But before we discuss the double-slit experiment, let us go back to Einstein's 1905 geometry.

Euclid's geometry is a theoretical geometry about a theoretical space that does not, in fact, exist. And Newton's physics is a theoretical physics about a theoretical world that does not, in fact, exist. So we had to change all that with Relativity Theory and Quantum Mechanics. In 1905 Einstein succeeded in putting time into the geometry where it belongs. He changed our geometry from 3D to 4D. In Pythagoras' [modified] theorem for four dimensions, time comes in squared with a minus sign, so that if the space and time separations between two events are equal, the total space-time separation between them is zero. It is **objectively** zero. [Notice that] distances in space are **not objective**, nor are lengths of time. Observers moving with respect to each other may disagree on how far it is from there to here and on how long it took from then until now, but they will all agree on the total space-time separation between "there-then" and "here-now". Four dimensional addresses (where and when) are objective, and the space-time intervals between them are also objective, regardless of your position or your state of motion.

Now in discussing the double-slit experiment, it will be important to remember what happened to our geometry in 1905. Space and time come into that geometry as a pair of opposites. And since, between the emission and absorption events of a single photon, the time separation is always equal to the space separation (for all observers), the total separation between these two events must always be zero. [As such,] when Einstein threw out the "luminiferous ether" he should have thrown out the photons that moved with it. They [actually] do not show up in his physics. When he threw out the lake he should have thrown out the fish that swam in it.

The mystery of the double-slit experiment is this: that if the photons go one at a time through the two slits, how do they "know" that both slits are open?

From a little distance away we shoot a laser through two closely spaced slits and then we watch the absorption events on a scintillating screen located behind the slits. What we see is that when one slit is closed, most of the scintillation points fall behind the other slit, just as we would expect. But when both slits are open, most of the scintillation points fall not behind two slits as we would expect, but *between* them. It is as though the photons had come through as waves and show an interference pattern on the screen. And the question is this: since the photons come through one at a time, how do they know that both slits are open?

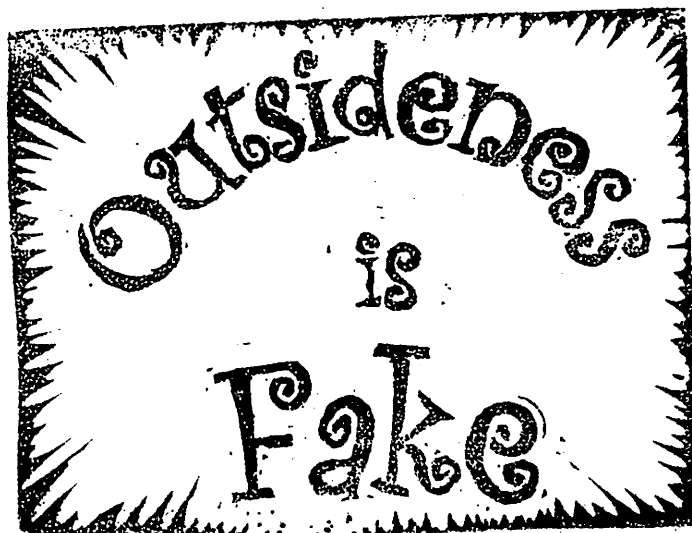
It will be necessary here to remember that space and time are a pair of opposites and that the total separation between the emission and absorption events of these single photons is zero. The emission and absorption events are adjacent in space-time. Now this adjacency has two components, a space component and a time component. It is in the space component of the adjacency that both slits are open. It is *not* that the photons go through one or the other slit, but only that the space components of the trajectories have both slits open.

Now suppose we do the double-slit experiment with electrons instead of photons. In this case the emission and absorption events will not be adjacent in space-time, because electrons can not travel at the speed of light. So then the space and time components of the trajectories will not be equal. What then? *Still we get the same result.* If both slits are open, we get interference patterns on the screen behind the slits. Why? Because even if the space and time components of the trajectories are not equal, still both slits are open for the space components.

As Amit Goswami says, "We never, ever see the wave aspect of a single quantum object." The wave aspect is in the space component of the trajectory.

Feynman's "sum-over-histories" approach suggests that we must allow that the photon (or the electron) could have gone by any possible way from the laser (or the electron gun) to the screen, and we sum-over-the-histories to calculate the probability of its arrival. Actually what we do is sum-over-the-space-components-of-the-trajectories, whether for a photon or for an electron.

For a detailed description of the double-slit experiment please see Richard Feynman's "Six Easy Pieces." It is in the last chapter on Quantum Behavior.



For Dan and Marie Gould

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THE EQUATIONS OF MAYA

"There cannot be two existences, only one."

Abstract

Modern cosmologists usually take non-existence for granted and hope to get the Universe out of nothing. But must we assume that in the absence of the Universe and in the absence of space and time there would be nothing? Or can we, without so rash an assumption, find clues to what might remain if instead we take existence for granted but leave out space and time? Could what remains, through apparition or *maya*, appear as this Universe? Can we, from what remains, get a Universe of gravity, electricity, and inertia?

Introduction

This is the one hundredth anniversary of the 1893 Parliament of Religions at which Swami Vivekananda¹ so eloquently proclaimed that all religions are true and that the proof of one is the proof of all. He said:

"If the Parliament of Religions has shown anything to the world it is this: it has proved to the world that holiness, purity, and charity are not the exclusive possessions of any church in the world, and that every system has produced men and women of the most exalted character. In the face of this evidence, if anybody dreams of the exclusive survival of his own religion and the destruction of others, I pity him from the bottom of my heart and point out to him that upon the banner of every religion will soon be written, in spite of resistance: 'Help and not fight; Assimilation and not Destruction; Harmony and Peace and not Dissension.'²

It was my hope in attending this present Parliament of the World's Religions, a hundred years after the Swami's ringing words were spoken, that the conflict between the various religions had been largely put behind us and that we could now address the conflict between science and religion. It was my hope that the conflict between science and the church which reigned in terror through the Spanish Inquisition might finally be put to rest. And I came here to say that if anyone dreams of the exclusive survival of religion and the destruction of science, I pity him from the bottom of my heart. And likewise, if anyone dreams

¹ Swami Vivekananda was a Hindu monk whose friends sent him to the Parliament to represent Hinduism. He was a disciple of Sri Ramakrishna who lived in a temple garden near Calcutta and who realized that all religions lead to the same goal. Sri Ramakrishna was born in 1836 and passed away in 1886. Swami Vivekananda was born in 1863 and passed away on the Fourth of July, 1902.

² *The World's Congress of Religions: The Addresses and Papers Delivered Before the Parliament.* New York: John Williams, 1894.

of the exclusive survival of science and the destruction of religion, I pity him from the bottom of my heart. In my mind, the proof of one is the proof of both.

Can we, by now, square science with religion? In particular, can we square Relativity and Quantum Mechanics with Swami Vivekananda's Advaita Vedanta?³ Since there cannot be two worlds – one for the scientists and one for the mystics – it must be that their descriptions are of the same world but from different points of view. Can we, from the vantage point of the Swami's Advaita (non-dualism), see both points of view? Swami Vivekananda said that science and religion would meet and shake hands. Can we see things from his vantage point?

Since the notion of *maya* or apparition as the first cause of our physics is central to the Swami's Advaita, I have chosen as my subject "The Equations of Maya". Can we find them in our physics? According to the Advaita Vedantins, as the Swami himself has said, there cannot be two existences, only One. And Maya is, as it were, a veil or screen through which that Oneness (the Absolute) is seen as this Universe of plurality and change.

³ Advaita Vedanta is a philosophy based on the notion that there can be only One Existence behind the plurality which we see. The word *Advaita* means "non-dual". The word *Vedanta* means "the culmination of knowledge". It refers also too some ancient Sanskrit scriptures (the Upanishads) where this philosophy is discussed.

The Equations of Maya

First we have to know what equations are. Second we have to know what the Vedantins mean by *maya*. And finally we have to take a hard look at our physics to see if any of our equations can be taken as descriptive of *maya*.

WHAT ARE EQUATIONS?

So what are equations? They are a kind of mathematical shorthand. They are just brief statements, usually in symbolic form like $2+2=4$. If you put that into English it reads, "two plus two equals four." There is nothing scary about it.

Essentially there are two kinds of equations: mathematical equations like the one just mentioned, and the equations of our physics. But mathematics is not about anything. "Two oranges plus two oranges equal four oranges" is about oranges, but $2+2=4$ is not about anything. Now physics is about something. It is about how matter behaves. So the equations of physics are about the behavior of matter and that is what concerns us here.

Newton's famous equation, $f=ma$, put into words means that the force required to accelerate an object is proportional to the product of the mass of that object and the rate of change of its velocity (acceleration). That means that when you are pushing a car to speed it up, how hard you have to push depends on how heavy the car is and how fast you want to speed it up. All of that is contained in that little statement, $f=ma$. It is just a kind of shorthand and it is not scary.

WHAT IS MAYA?

We've talked a little about equations; now we have to talk about *maya*. What is *maya*? First we know from the Upanishads⁴ that it is made of three *gunas*: called *tamas*, *rajas*, and *Sattva*. *Tamas* has its veiling power, called *avarana shakti* in Sanskrit. *Rajas* has its projecting power, called *vikshepa shakti* in Sanskrit, and *Sattva* has its revealing power, *prakasha shakti* in Sanskrit. Now this language, "veiling", "projecting", and "revealing" is the language of *perception*, not the language of *manufacture*. You can not make anything out of a *guna* as the Sankhyans⁵ wanted to do. These three *gunas*, of which *maya* is said to be made

⁴ The Upanishads are the philosophical sections of the ancient Sanskrit scriptures called the Vedas.

⁵ Sankhya is one of the six systems of Indian Philosophy. Sankhyans held that nature, *prakriti*, is one, and that souls are many. They believed that *prakriti* is active and the souls are passive, but *prakriti* dances for the souls. The ultimate aim of Sankhya is *kaivalya*, "isolation" (of the soul from *prakriti*).

of, are really just three aspects of a misperception. They are not substances, like wood, stone, or gold, out of which objects could be made. They are simply three aspects of an apparition. For example, in order to mistake a rope for a snake, you must fail to see the rope rightly. That is what one would call *the veiling power of tamas*. Then you must jump to the wrong conclusion. That is called *the projecting power of rajas*. You yourself "project" the snake. Regardless, the length and diameter of the rope are *still seen* as the length and diameter of the snake. That is called *the revealing power of Sattva*. For if you hadn't seen the rope in the first place you might have jumped to some other wrong conclusion.

Many of the Vedantins, when they write about the veiling and projecting powers of maya, leave out the revealing power. If you look in their books you'll find that they leave it out. But you cannot leave it out or the theory would be lame and the Universe would not run the way it does.

Thus we see from the Upanishads that maya is made of three gunas; that it is a mis-perception, a kind of magic; and that the Universe is therefore "apparitional", just like the snake for which a rope has been mistaken. But why does this apparition take the form of this Universe? Why do we see the physics that we see? The answer lies partly in the gunas and partly in perceiving space and time.

Swami Vivekananda said in one of his lectures⁶ that the Universe is the Absolute seen through the screen of time, space, and causation (*kala, desha, nimitta*). He said that time, space, and causation are like the glass through which the Absolute is seen, and when it is seen on the "lower" side, It appears as the Universe. So not only is the Universe "apparitional", it is the Absolute seen through space and time and this allows us to understand why the physics of the Universe takes the form that we see.

Swami Vivekananda once said that he could write a whole book on a single statement of Sri Ramakrishna, and I believe I could write a whole book on this single statement of the Swami.

Swami Vivekananda's statement that the Universe is the Absolute seen through the screen of time, space, and causation allows us to get some interesting information, albeit in negative terms, about what he calls the Absolute. For example, since It is not in time, it cannot be changing. Change takes place only in time. And since It is not space, it must be undivided, because dividedness and separation occur only in space. Since It is therefore One and Undivided it must also be Infinite, since there is no "other" to limit it.

Now "changeless", "infinite", and "undivided" are really negative statements, but they will suffice. We can trace the physics of our Universe from these three

⁶ Vivekananda, Swami. *The Complete Works of Swami Vivekananda, Volume 2. "The Absolute and Manifestation"*. Mayavati: Advaita Ashrama, 1948.

negative statements. If we don't see the Absolute as what it is we will see it as something else. If we don't see it as Changeless, Infinite, and Undivided, we will see it as changing, finite, and divided, since in this case there is no other else. There is no other way to mistake the Changeless except as somehow changing. So we see a Universe which is changing all the time, made up of minuscule particles, and divided into atoms.

However, due to the revealing power, the changelessness, the infinitude, and the undividedness *must always* show through. How is this possible? The Changeless shows through within us as our yearning for peace and security; and it shows through in what we see "outside" as matter as its mass or inertia. The Infinite shows within us as our yearning for freedom, and it shows in what we see as matter as the electrical charge on the minuscule particles. The Undivided shows within us as love, and it shows in what we see as matter as gravity and the attraction between opposites like positive and negative electrical charges.

The Universe is "wound up" against gravity only because the undividedness shows through. It is "wound up" against electricity only because the infinitude shows through. Gravity, electricity, and inertia are simply the nature of the "underlying existence" (the Absolute) showing through, just as the length and diameter of the rope show through in the apparitional snake for which it has been mistaken. What we see as energy is simply the "underlying existence" showing through. Everything that happens, happens because of That.

Causation

So we have seen from the Upanishads that *maya* is made of three *gunas*. The Sankhyans call it *prakriti*, the first cause, and we have seen that the first cause must be "apparitional". As Swami Vivekananda said, the Universe is the Absolute seen through the screen of time, space, and causation. Here I need to say a few words about causation, because what we ordinarily see as causation is not "apparitional". It is "transformational". Chevys do not arise by apparition; they come from Detroit. Although, as we have seen, the first cause of our physics is apparitional, it leaves us with a Universe "wound up" with energy, and the transformations run on their own accord. *Gravity arises by apparition, but falling is transformational*. The gravitational energy is transformed into kinetic energy without any change in the amount of energy.

As you may know, philosophical systems in India are catalogued according to their understanding of causation. The Sankhyans were *Parinamavadins*. They believed in *parinama* or "transformational causation", like making milk into buttermilk. The milk is transformed into buttermilk. The Advaita Vedantins are *Vivartavadins*. They believe the first cause is *vivarta*, or "apparition", like mistaking a rope for a snake. Now these are very different things. When milk is transformed into buttermilk it is a change that takes place in time. It is a *happening*, and there is a shelf life on your buttermilk. There is a date on it. But mistaking a rope for a snake is not a happening in that sense. It is not that you

mistook the rope for a snake yesterday and now there is a snake in your kitchen and you don't dare open the door. It is a mistake you are making now; it is something you are doing *now*.

Transformational Causation

The rules that govern "transformational causation" are very well understood at the Universities. They know that the energy that goes into an operation at the beginning comes out at the end. Although the form of the energy may change, you never get any new energy that way. It is like pouring gold. You melt it and pour it into a set of forms. Then you re-melt it and pour it into another set of forms. You never get any richer that way. No matter how many times you re-melt it, you never get any new gold. "Transformational causation" is like that. What you put in at the beginning comes out at the end. It is governed by the Conservation laws. Whether it is matter, energy, momentum, or electrical charge – whatever you put in at the beginning comes out at the end. Since the Universe is made out of energy, the changes of which are governed by these Conservation laws, the Universe cannot have arisen through "transformational causation". It cannot have come out of nothing.

Apparitional Causation

What I have referred to as "apparitional causation" is a very different thing than "transformational causation". When you mistake a rope for a snake the rope is *not transformed* into a snake. It is just a mistake, and it is something you are doing *now*. So the question is not, "How did the Absolute become the Universe?" That cannot be answered. The Absolute has not "become" the Universe. The proper question is, "Why do we see it that way? Why do we feel that we are bound? Why do we continue to make this mistake? Why are we unable to see through the apparition?" And those questions can be answered.

On December 14th 1882, Vijaykrishna Goswami asked Sri Ramakrishna this question: "Sir, why are we bound like this? Why don't we see God?" Sri Ramakrishna answered:

"Maya is nothing but the egotism of the embodied soul. This egotism has covered everything like a veil. 'All troubles come to an end when the ego dies'. If, by the grace of God, a man but once realizes that he is not the doer, then he at once becomes a *jivanmukta*. Though living in the body, he is liberated; he has nothing else to fear."⁷

What is egotism?

⁷ Nikhilananda, Swami, tr. *The Gospel of Sri Ramakrishna*. New York: Ramakrishna-Vivekananda Center, 1942.

So *maya*, the first cause, is made of three *gunas* and consists of seeing the Absolute through the screen of time, space, and causation. And we continue to see it thus because of egotism. *But what is this egotism?*

Those of you who have read Erwin Schrodinger's little book called, *What is Life?*⁸ may already recall that egotism is a genetic invention to keep a living organism alive. The defining characteristic of a living organism is that it must be able to direct a *stream of negative entropy* upon itself. That is, it must find and use a source of energy that is less scrambled at the start. Entropy is a measure of the "scrambledness" of the energy. Every living organism scrambles the energy in its environment. Negative entropy is a measure of the usability (the "unscrambledness") of the energy. We get our negative entropy by eating and breathing. The plants get their negative entropy from the Sun. In most transformational processes, the scrambledness of the energy will go up. That is, the entropy goes up. It *never* goes down. At least locally entropy is going up; the Universe is running down.

Every living organism must direct a stream of negative entropy upon itself to stay alive. As such, life is impossible except in a situation that is going from bad to worse. So if you want to enjoy the "good old days", do it now! All living organisms live in this cascade of increasing entropy by directing streams of the increase in entropy through their forms. And egotism is a genetic invention required by this necessity.

Prime Directives

The two prime directives of genetic programming are to direct a stream of negative entropy upon the organism and to pass on the genetic line. The egotism required for the fulfillment of these prime directives is what Sri Ramakrishna referred to as the "unripe ego". The discrimination is made between the organism and its environment for the sake of fulfilling these two directives. Sri Ramakrishna, when speaking to men, referred to these two prime directives as "woman and gold" – "gold" for directing a stream of negative entropy upon the organism; and "woman" for passing on the genetic line. When speaking to women he said "men" and "gold". He often said, when speaking to men, "*Maya is nothing but woman and gold.*"

Genetic Programming

It should be noted that this language – "genetic programming" – was not current in Sri Ramakrishna's day. So far as I know some of the first items that were published on the subject of genetics were Mendel's experiments, and I don't think they hit the press until 1900. Regardless, if we translate Sri Ramakrishna's remarks into that language they say very clearly that *maya is nothing but our genetic programming.*

⁸ Schrodinger, Erwin. *What is Life?*. Cambridge, Mass.: Cambridge University Press, 1967.

You remember that the question was not how the Absolute has become the Universe, but rather why do we continue to see it that way? And the answer is that it is because of egotism, and that egotism turns out to be nothing but our genetic programming. It is the genetic expectation that “keeps the wool pulled over our eyes.” It is the expectation that by following the dictates of our genes that we will reach the peace and security of the Changeless, the freedom of the Infinite, and the bliss of the Undivided. But really that is just a genetic mirage.

We are programmed to eat, breathe, and mate. But wait, not so fast! It actually goes in steps. The male programming for passing on the genetic line goes like this: In the absence of females, seek females. In the presence of females, select. In the presence of a selected female, start a conversation. Ask her where she is from. Ask her where she is going. Ask her out to dinner. And the rest you know. We are all descended from ancestors who were programmed this way and who passed on the genetic line...

So much for that problem, but how about the question of where do we get our negative entropy?

Negative Entropy

We get our negative entropy by eating and breathing, and we get it from the plants (either directly or indirectly). The plants get their negative entropy from the Sun. They make reducing agents for their own use and dump oxygen out as waste. We munch down the reducing agents and huff and puff on the oxygen and run around on “canned” sunlight. And we feel that we are the “doers”. But that is just a genetic mirage. We are not the “doers”. It is all just recycled sunlight.

Sometimes when you read in *The Gospel of Sri Ramakrishna* that he says that we are not the doers, you might think that he is asking us to *pretend* that we are not the doers. No, he never makes that kind of mistake. He is not asking us to make-believe anything. He is asking us to discriminate between the Real and the make-believe and to let the make-believe go.

I once wrote to Swami Yogeshananda that this earth can't bloom a flower. Without the Sun, no plants would bloom. Without the falling hydrogen, no Suns would shine. And without the entire Universe, no hydrogen would fall. So I said this whole Universe blooms the flower. By this whole Universe the Robin sings. *But by what blooms this Universe?* It is the nature of the Absolute showing through in space and time that blooms this Universe. It is the revealing power of *maya*. The dream is in the Dreamer, and *the dream is alive*.

So it is our genetic programming that keeps the wool pulled over our eyes. However, our genetic programming comes in batches and that gives us a loophole – a genetic loophole. No other animal on the face of this planet has a childhood like ours.

Childhood

We have a whole batch of genetic programming for being children; another whole batch for being adults; and a third whole batch for being parents. But no one has a childhood like ours, and we owe our childhood to our parents. Directing a stream of negative entropy upon ourselves and on our children falls mostly to the parent batch. Passing on the genetic line falls mostly to the adult batch. But the children are free. Children do not direct streams of negative entropy upon themselves – “Mommy does it”. And children do not pass on the genetic line – “Mommy does it”. Children do not follow the prime directives. If you ask a child what he is going to do today, he says, “I’m going to play. That is what kids do.” As Sri Ramakrishna said, “The ego of a child is nothing like the ego of a grown-up man.” You see, they both make sand castles at the beach; then the kids run through them with their feet, but the grown-ups take pictures.

The Beach

We owe our unique childhood to our sojourn on the beaches of north-east Africa according to Elaine Morgan, author of *The Aquatic Ape*.⁹ She believes that we were probably marooned on an island a few million years ago. There, now in the absence of a jungle, we were forced to eat at the beach. And it was there, when our body language failed in the surf, that we first learned to talk. It was also there, to accommodate the change, that we prolonged our childhood. That is why our parenting batch is so different from that of all the other animals. That is why curiosity and the wonder of our childhood never come to an end. We are the children of children who never grow up.

However, there is an escape route through this genetic loophole. Don’t forget it! *Children don’t follow the two prime directives of the genetic programming.* And neither did Sri Ramakrishna. Although he practiced all sorts of spiritual exercises, his native way to go was to think of himself as a child and of God as Mother.

THE EQUATIONS OF MAYA

We have talked a little bit about equations and a great deal about maya. Now we have to take a hard look at our physics to see if any of our equations can be taken as descriptive of *maya*.

First of all, let me remind you that the physics of the last century – the physics of Swami Vivekananda’s day – was nothing like the physics of this century. In those days it was taken for granted that the mix of the chemical elements in the Universe had been given at the time of creation – if there was a creation – or had been around forever – if there was a forever. It was thought that if you just kept

⁹ Morgan, Elaine. *The Aquatic Ape*. New York: Stein and Day, 1982.

shuffling the mix long enough it would come out in the present configuration once again. The Swami sometimes referred to that view. However, do not take it as "gospel truth" as he is just quoting the scientific view of his day.

In those days it was also taken for granted that the Universe consisted of "real" particles with "real" mass and "real" energy moving through "real" space in "real" time. It was taken for granted that mass and energy were different things and that space and time were independent of each other. It was assumed that if we knew the present position and momentum of these particles we could predict the entire past and future of the Universe. However, no one thinks like that now. There have been some major revolutions in our understanding of physics since then and they began just after Swami Vivekananda passed away.

Relativity

In the winter of 1895-96 Swami Vivekananda apparently met with Nikola Tesla and asked him if he could show that what we call matter was really just potential energy. The Swami wrote, "I am to go and see him next week to get this new mathematical demonstration."¹⁰ However it never came. It is unfortunate that Tesla didn't get it shown, because had Relativity Theory arisen out of a suggestion by Swami Vivekananda the history of modern physics might have looked very different. Regardless, the notion that what we see as matter is just potential energy was actually published as an appendix to Einstein's Relativity Paper ten years later, in 1905.

In 1905 Einstein changed our geometry from 3-D to 4-D. He put time into our geometry where it belongs. Time and space come into our geometry as a pair of opposites, so that if the space separation and the time separation between two events, say, "here-now" and "there-then", are equal, then the *total* separation between those two events is zero.

Euclid had assumed that space separations are "objective". But it turns out that Euclid's geometry is really a theoretical geometry about a theoretical space that does not, in fact, exist. Space separations, and separations in time, are *not* objective. Einstein pointed out that observers moving with respect to each other measure different distances between "there" and "here", and also different time between "then" and "now". What *is* objective is the *total* separation, the space-time separation, between "there-then" and "here-now".

Einstein's actual equation still looks very much like the Pythagoras equation for the length of the hypotenuse of a right triangle. In the Pythagoras equation you square the two sides of the triangle, then add these squares, and then take the square root of that sum to get the length of the hypotenuse. But in Einstein's equation, to get the space-time separation between two events you square the time separation and *subtract it* from the square of the space separation, and then

¹⁰ Vivekananda, Swami. *The Complete Works of Swami Vivekananda, Volume 5*. Mayavati: Advaita Ashrama, 1948.

take the square root of that *difference*.¹¹ That means that if the space and time separations between those two events are equal the total separation between them is zero. That puts the separation between the perceiver and the perceived at zero, because we always see events “away” from us in space by the trick of seeing them “back” in time in just such a way that the *total* separation equals zero. This separation equation, as I see it, is one of the basic equations of *maya*. If this Universe is “apparitional”, like in a dream, then the “real” separation between the dreamer and the dream must equal zero.

It was this change in the geometry that allowed Einstein to realize that what we see as mass (matter) is just potential energy. $E=mc^2$. This is the equation that Swami Vivekananda had hoped to get from Tesla. In it we see that matter (mass) as well as energy is just the “underlying existence” showing through in the apparition. So this equation is also an equation of *maya*.¹²

There are many things which are much easier to see now than they were in Einstein’s day – before the discovery of neutron stars and before the suspicion of the existence of black holes went public. It is easy to see now that the gravitational energy transformed to kinetic energy in the falling of an object to the surface of a neutron star would be $1/10^{\text{th}}$ of its rest mass. As such the energy released in the splash of a 10-gram marshmallow onto a neutron star would be enough to vaporize a town. It is also easy to see now that falling into the event horizon of a black hole would release $1/3^{\text{rd}}$ of the energy, and that all of the energy would be released if that black hole contained all the rest of the matter in the observable Universe.

It is easy to see now that, as Einstein said in 1917, “There can be no inertia relative to ‘space’, but only inertia of masses relative to one another.” And it is also easy to see now that the inertia is actually related to their separation in the gravitational field and not their proximity to each other (as Einstein seems to have thought).¹³

It is easy to see now that Universe is “wound up” against gravity because the Undivided is showing through the apparent separation. It is also easy to see now that the Universe is “wound up” against the electrical charges of the miniscule

¹¹ $S^2=x^2-t^2$, where x and y are the space and time separations between the two events, and S is the total space-time separation.

¹² This equation is often written as $E=mc^2$, where c is the speed of light or 3×10^{10} cm/sec. In Einstein’s day the unit for energy was the erg, and the unit for mass was the gram. But when we found out that mass and energy were the same thing we had to know how many ergs make a gram. Now one gram is the energy of an atomic bomb, and one erg is the kinetic energy of a 2-gram beetle walking 1 centimeter per second. So $E=mc^2$ says that, carefully handled, the kinetic energy of 9×10^{20} 2-gram beetles walking 1 centimeter per second would vaporize Berkeley.

¹³ Gardner, Martin. *The Relativity Explosion*. New York: Vintage Books, 1976. Page 123.

particles because the Infinite is showing through in their smallness.¹⁴ We owe a great deal of these considerations to Einstein. However there is another revolution that has taken place in our physics which is considered even more basic than Einstein's change in our geometry. That is quantum mechanics.

Quantum Mechanics

Matter does not behave according to our genetic expectations. Our genetic expectations are Newtonian. They assume Euclidean geometry and they assume Newtonian physics. They take for granted that space separations are "real" and the causation is [only] transformational. That is why so many people have so much trouble "understanding" relativity and quantum mechanics. Our genetic expectations are offended. We cannot easily accept the fact that it is impossible to know everything about a physical system, just as it is impossible to identify that snake for which a rope has been mistaken. Regardless, there is a deep uncertainty lying at the bottom of our physics.

In the late 1920's Werner Heisenberg pointed out that the product of our necessary uncertainty in where a particle is and our necessary uncertainty in its momentum can never be smaller than Planck's constant over two pi. He also showed that the product of our necessary uncertainty in when something happens and our necessary uncertainty in the energy of the happening can never be less than that same amount. This is Heisenberg's Uncertainty Principle, which I take to be yet another of the equations of *maya*. What it says is that if we see what we see through the screen of time and space we cannot quite tell what it is that we see.

Richard Feynman has said that every statement in quantum mechanics is just a restatement of Heisenberg's Uncertainty Principle. This quantum behavior is what keeps the electron from "sitting down" on the proton in a hydrogen atom in spite of the enormous electrical attraction between them. For if we knew with that much precision about the position of the electron our necessary uncertainty in its momentum would be so large that the momentum associated with that uncertainty would be enough to drive it off. That is also why we don't just simply fall through the floor. If the electrons are pushed too close to the nuclei they simply "buzz harder" and keep us up. That is why the planets don't collapse. It is the uncertainty necessitated by the fact that the first cause of our physics is apparitional.

Summary

These three equations, as I see it, are some of the equations of *maya*. Einstein's separation equation sets the separation between the perceiver and the perceived at zero. *The dream is in the dreamer*. We see the bright star Sirius eight and a half light years away from us by the trick of seeing it eight and a half years ago.

¹⁴ The gravitational energy of the Universe would go to zero if and only if the dividedness went to zero just as the electrical energy of an electrical particle would go to zero if and only if the size of that particle went to infinity.

The distance "away" comes in squared with a plus sign but the time "ago" comes in squared with a minus sign so that if the two are equal the total separation goes to zero.

Einstein's more famous equation, $E=mc^2$, "...in which energy is set equal to mass," is the equation which Swami Vivekananda had hoped to get from Nicola Tesla because, he said, "There cannot be two existences, only one."

Finally Heisenberg's Uncertainty Principle includes the notion that the observer is always mixed up in what he sees. There is no longer any talk of a Universe "independent" of the observer any more than there is talk of an apparitional snake independent of the person who is seeing the apparition.

Whence and Whither?

For a long time I have felt that the physicists were just on the verge of noticing that the first cause of our physics is "apparitional" – that our physics is the physics of an apparitional Universe. I mentioned this to Johnny Carson when I was on his show a couple of years ago. I said then that when you mistake a rope for a snake what you do is to look at it very carefully, and you notice that it has these diagonal markings on its back. So you think, "It looks like a rope. Have we had ropes long enough for the snakes to imitate them?" You then decide to call it a "rope-snake". But then you look carefully at the end where the rattles should have been and you see hemp fibers instead. "Aha! Rope-snake hempii." There was so much laughter that I could not finish. We were cut off by the music. But what I wanted to say was that when you find that the head end is also hemp fibers you realize that it really was a rope all along. I wanted to say that only this last step has not yet been taken by the physicists. Relativity and quantum mechanics are not about an "actual" Universe. We already have the physics of an apparition.

There are some interesting differences between the physicists and the mystics. The mystics take *existence* for granted. They want to get from here to there. They want to see beyond the apparition. But the physicists are likely to take *non-existence* for granted. And they want to get from there to here. The Big Bang cosmologists want to get the Universe out of nothing. It is like asking us to believe that nothing made everything out of nothing. But that is not what shows up in our physics. If behind what we see there were only a zero then where would gravity come from, and electricity, and inertia? So I have to side with the mystics. On observational grounds I have to take existence for granted.

Another interesting difference is that the physicists are clearly Parinamavadins. They believe that causation is transformational and that the Universe is actual, whereas the mystics are Vivartavadins. Regardless of what they write in their books or what they say from the pulpit, all the mystics and religious aspirants agree that *faith is at the root of spiritual experience*. However, that would not be possible *unless the Universe were apparitional*. If the milk has been made into

buttermilk, faith that it is really milk would be of *no avail*; whereas, if you have mistaken your friend for a ghost, faith that it is really your friend ends the problem.

Here let me remind you that physics and philosophy are our maps. They can be judged as true or false according to whether they correspond or do not correspond to fact. But mysticism (or religion) is a journey, and about a journey one does not ask whether it is true or false, but only where it goes. Will it take me to the goal?

Our problem is to reach the goal, to see beyond the screen. You remember that Swami Vivekananda said that the Universe is the Absolute seen through the screen of time, space, and causation. It is no use asking how the Absolute became the Universe. The Absolute has not become the Universe any more than the rope has become a snake. Our problem is just to see it straight.

You remember that Sri Ramakrishna said that *maya* is nothing but the egotism of the embodied soul. That is genetic. The prime directives of the genetic programming are to direct a stream of negative entropy upon ourselves and to pass on the genetic line. That is why we feel ourselves to be the doers of action and the enjoyers of its fruits. It is just a genetic mirage. The genes have us persuaded that by following their dictates we will reach the peace of the Changeless, the freedom of the Infinite, and the bliss of the Undivided. But they don't have it to give. We don't get the Undivided, we get a family. You must have noticed.

Our problem is to reach the goal and *not be hoodwinked* by the genes. However this is not a journey from one place to another in an "actual" world. It is a journey *from one point of view to another*. That is why it is often referred to as an "inner journey". It is a journey from an erroneous point of view, dictated by the genes, to a point of view from which we can see through the genetic mirage.

Counter-cheating the Genes

It is important to remember that our problem is genetic. As James Burke says, "If you don't know how you got somewhere, you don't know where you are." And as I say, "If you don't know where you are, how will you know where to go?" In order to "counter-cheat" the genes we need to know how they have cheated us.

In an apparitional Universe, as seen in time and space, there are only three drives to catch hold of: the drive for the Changeless which we see in matter as inertia and in ourselves as our yearning for peace and security; the drive for the Infinite which we see in matter as electricity and in ourselves as our yearning for freedom; and the drive for the Undivided which we see in matter as gravity and in ourselves as our yearning for love and bliss. There are no other drives for the genes to catch hold of. So they have caught hold of these three and then persuaded us to run after them in ways that get their genetic necessities fulfilled

– in ways that fulfill their prime directives. Unfortunately, *the fulfillment of a genetic necessity does not confer on the organism the fulfillment of the yearning that drives it.* The yearnings have been borrowed by the genes, but the genes have also left some loopholes which we built in at the beach long ago.

All our spirituality began at that beach – our breath control, our speech, our music and our hymns, our worship, our mantras and our prayers. There at the beach we built in parenting and childhood and the ability to pass on what we know. Now we are smart enough to counter-cheat the genes, to use the genes themselves to help us see behind the screen. Every human emotion can be redirected from the fulfillment of a genetic necessity to the fulfillment of our spiritual quest. Remember, our childhood batch is unique; children do not go along with the prime directives of the genetic programming. “The ego of a child is nothing like the ego of a grown up man.”

Let me remind you that space is not that which separates the many, but that which *seems* to separate the *One*. And in that space that Oneness shines, therefore falls whatever falls. Space is not that in which we see the small, but that in which the Infinite *appears* as small. And in that space that infinite vastness shines, therefore bursts whatever bursts, therefore shines whatever shines. Finally, time is not that in which we see the changing, but that in which the Changeless *seems* to change. And in that time that Changeless shines, therefore rests whatever rests, therefore coasts whatever coasts.

Swami Vivekananda once said that science and religion would meet and shake hands. I think that time has come.

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The Equations of Maya

"There cannot be two existences, only one."

Abstract

Modern cosmologists usually take non-existence for granted and hope to get the Universe out of nothing. But must we assume that in the absence of the Universe and in the absence of space and time there would be nothing? Or can we, without so rash an assumption, find clues to what might remain if instead we take existence for granted but leave out space and time? Could what remains, through apparition or *maya*, appear as this Universe? Can we, from what remains, get a Universe of gravity, electricity and inertia?

Introduction

This is the one hundredth anniversary of the 1893 Parliament of Religions at which Swami Vivekananda¹ so eloquently proclaimed that all religions are true and that the proof of one is the proof of all. He said,

"If the Parliament of Religions has shown anything to the world it is this: it has proved to the world that holiness, purity, and charity are not the exclusive possessions of any church in the world, and that every system has produced men and women of the most exalted character. In the face of this evidence, if anybody dreams of the exclusive survival of his own religion and the destruction of the others, I pity him from the bottom of my heart and point out to him that upon the banner of every religion will soon be written, in spite of resistance: 'Help and not fight; Assimilation and not Destruction; Harmony and Peace and not Dissension'."²

It was my hope in attending this present Parliament of the World's Religions, a hundred years after the swami's ringing words were spoken, that the conflict between the various religions had been largely put behind us and that we could now address the conflict between science and religion. It was my hope that the conflict between science and the church which reigned in terror through the Spanish Inquisition might finally be put to rest. And I came here to say that if anyone dreams of the exclusive survival of religion and the destruction of science, I pity him from the bottom of my heart. And likewise, if anyone dreams of the exclusive survival of science and the

¹ Swami Vivekananda was a Hindu monk whose friends sent him to the Parliament to represent Hinduism. He was a disciple of Sri Ramakrishna who lived in a temple garden near Calcutta and who realized that all religions lead to the same goal. Sri Ramakrishna was born in 1836 and passed away in 1886. Swami Vivekananda was born in 1863 and passed away on the Fourth of July, 1902.

² *The World's Congress of Religions: The Addresses and Papers Delivered Before the Parliament.* New York: John Williams, 1894.

destruction of religion, I pity him from the bottom of my heart. In my mind, the proof of one is the proof of both:

Can we, by now, square science with religion? In particular, can we square relativity and quantum mechanics with Swami Vivekananda's Advaita Vedanta?³ Since there cannot be two worlds--one for the scientists and one for the mystics--it must be that their descriptions are of the same world but from different points of view. Can we, from the vantage point of the swami's Advaita (non-dualism), see both points of view? Swami Vivekananda said that science and religion would meet and shake hands. Can we see things from his vantage point?

Since the notion of *maya* or apparition as the first cause of our physics is central to the swami's Advaita, I have chosen as my subject "The Equations of Maya". Can we find them in our physics? According to the philosophy of the Advaita Vedantins, as the swami himself has said, there cannot be two existences, only one. And *maya* is, as it were, a veil or screen through which that oneness (the Absolute) is seen as this Universe of plurality and change.

³ Advaita Vedanta is a philosophy based on the notion that there can be only one existence behind the plurality which we see. The word *advaita* means 'non-dual'. The word *vedanta* means 'the culmination of knowledge'. It refers also to some ancient Sanskrit scriptures (the Upanishads) where this philosophy is discussed.

The Equations of Maya

First, we have to know what equations are. Second, we have to know what the Vedantins mean by *maya*. And finally, we have to take a hard look at our physics to see if any of our equations can be taken as descriptive of *maya*.

WHAT ARE EQUATIONS?

So, what are equations? They are a kind of mathematical shorthand. They are just brief statements, usually in symbolic form like $2+2=4$. If you put that in English, it reads, "two plus two equals four." There's nothing scary about it. But essentially, there are two kinds of equations: mathematical equations, like the one just mentioned, and the equations of our physics. But mathematics is not about anything. Two oranges plus two oranges equals four oranges is about oranges, but $2+2=4$ is not about anything. Now physics is about something; it is about how matter behaves. So the equations of physics are about the behavior of matter, and that's what concerns us here. Newton's famous equation, $f=ma$, put into words, means that the force required to accelerate an object is proportional to the product of the mass of that object and the rate of change of its velocity. That means that when you're pushing a car to speed it up, how hard you have to push depends on how heavy the car is and how fast you have to speed it up. All that is contained in that little statement, $f=ma$. It's just a kind of shorthand, and it's not scary.

WHAT IS MAYA?

We've talked a little about equations; now we have to talk about *maya*. What is *maya*? First, we know from the Upanishads⁴ that it is made of three *gunas*: *tamas*, *rajas*, and *sattva*. *Tamas* has its veiling power, *avarana shakti* in Sanskrit. *Rajas* has its projecting power, *vikshepa shakti* in Sanskrit, and *sattva* has its revealing power, *prakasha shakti* in Sanskrit. Now this language, "veiling" and "revealing", is the language of *perception*, not the language of *manufacture*. You can't make anything out of a *guna* as the Sankhyans⁵ wanted to do. These three *gunas*, of which *maya* is said to be made, are just three aspects of a misperception. They are not substances, like wood, stone, or gold, out of which objects could be made. They are simply three aspects of an apparition. In order to mistake a rope for a snake, you must fail to see the rope

⁴ The Upanishads are the philosophical sections of the ancient Sanskrit scriptures called the Vedas.

⁵ Sankhya is one of the six systems of Indian philosophy. Sankhyans held that nature, *prakriti*, is one, and that souls are many. They believed that *prakriti* is active and the souls are passive, but *prakriti* dances for the souls. The ultimate aim of Sankhya is *kaivalya*, 'isolation' (of the soul from *prakriti*).

rightly; that's the veiling power of *tamas*. Then you must jump to the wrong conclusion; that's the projecting power of *rajas*. *You yourself* project the snake. But the length and diameter of the rope are seen as the length and diameter of the snake; that's the revealing power of *sattva*. If you hadn't seen the rope, you might have jumped to some other wrong conclusion.

But many of the Vedantins, when they write about the veiling and projecting powers of *maya*, leave the revealing power out. You look in the books--you'll find they leave it out. But you cannot leave it out or the theory would be lame and the Universe wouldn't run.

So we see from the Upanishads that *maya* is made of three *gunas*, that it is a misperception, a kind of magic, and that the Universe is therefore apparitional, like the snake for which a rope has been mistaken. But why does the apparition take the form of this Universe? Why do we see the physics that we see? Partly it is the *gunas* and partly it is space and time.

Swami Vivekananda said in one of his lectures⁶ that the Universe is the Absolute seen through the screen of time, space, and causation (*kala, desha, nimitta*). He said that time, space, and causation are like the glass through which the Absolute is seen, and when It is seen on the lower side, It appears as the Universe. So not only is the Universe apparitional, it's the Absolute seen through time and space, and that allows us to understand why the physics of the Universe takes the form that we see.

Swami Vivekananda said that he could write a whole book on a single statement of Sri Ramakrishna, and I could write a whole book on this single statement of the swami.

Now Swami Vivekananda's statement that the Universe is the Absolute seen through the screen of time, space and causation allows us to get some interesting information, albeit in negative terms, about what he calls the Absolute. Since it is not in time, it cannot be changing. Change takes place only in time. And since it is not in space, it must be undivided, because dividedness and separation occur only in space. And since it is therefore one and undivided, it must also be infinite, since there is no "other" to limit it. Now "changeless", "infinite", and "undivided" are negative statements, but they will suffice. We can trace the physics of our Universe from these three negative statements. If we don't see the Absolute as what it is, we'll see it as something else. If we don't see it as changeless, infinite, and undivided, we'll see it as changing, finite, and divided, since in this case there is no other else. There is no other way to mistake the changeless except as changing. So we see a Universe which is changing all the time, made of minuscule particles, and divided into atoms.

But because of the revealing power, the changelessness, the infinitude, and the undividedness show through. The changeless shows through in us as our yearning for

⁶ Vivekananda, Swami. *The Complete Works of Swami Vivekananda*. Volume 2. "The Absolute and Manifestation". Mayavati: Advaita Ashrama, 1948.

peace and security and it shows in what we see as matter as its mass or inertia. The infinite shows in us as our yearning for freedom, and it shows in what we see as matter as the electrical charge on the minuscule particles. And the undivided shows in us as love, and it shows in what we see as matter as gravity and the attraction between opposites like positive and negative electrical charges. The Universe is "wound up" against gravity only because the undividedness shows through. And it is "wound up" against electricity only because the infinitude shows through. Gravity, electricity, and inertia are simply the nature of the underlying existence showing through, just as the length and diameter of the rope show through in the snake for which it has been mistaken. What we see as energy is simply the underlying existence showing through. Everything that happens, happens because of that.

Causation

So we have seen, from the Upanishads, that *maya* is made of three *gunas*. The Sankhyans call it *prakriti*, the first cause, and we have seen that the first cause must be apparitional. As Swami Vivekananda said, the Universe is the Absolute seen through the screen of time, space, and causation. Here I need to say a few words about causation, because what we ordinarily see as causation is not apparitional. It is transformational. Chevys do not arise by apparition; they come from Detroit. Although, as we have seen, the first cause of our physics is apparitional, it leaves us with a Universe wound up with energy, and the transformations run on of their own accord. *Gravity arises by apparition, but falling is transformational*. The gravitational energy is transformed to kinetic energy without any change in the amount.

As you may know, philosophical systems, in India, are catalogued according to their understanding of causation. The Sankhyans were Parinamavadins. They believed in *parinama*, transformational causation, like making milk into buttermilk. The milk is transformed into buttermilk. The Advaita Vedantins are Vivartavadins. They believe that the first cause is *vivarta*, apparition, like mistaking a rope for a snake. Now these are very different things. When milk is transformed into buttermilk, it's a change that takes place in time. It's a *happening*, and there's a shelf life on your buttermilk. There's a date on it. But mistaking a rope for a snake is not a happening in that sense. It is not that you mistook the rope for a snake yesterday and now there's a snake in your kitchen and you don't dare open the door. It's a mistake you are making now; it's something you're doing *now*.

Transformational Causation

Now the rules that govern transformational causation are very well understood at the universities. The energy that goes into an operation at the beginning comes out at the end. Although the form of the energy may change, you never get any new energy that way. It's like pouring gold. You melt it and pour it into a set of forms. Then you remelt it and pour it into another set of forms. You never get rich that way. No matter how many times you remelt it, you never get any new gold. Transformational causation is like that. What you put in at the beginning comes out at the end. It is governed by the conservation laws. Whether it's matter, energy, momentum or electrical charge--

whatever you put in at the beginning comes out at the end. And since the Universe is made out of energy, the changes of which are governed by these conservation laws, the Universe cannot have arisen through transformational causation. It cannot have come out of nothing.

Apparitional Causation

But what I have referred to as apparitional causation is a very different thing. When you mistake a rope for a snake, the rope is not transformed into a snake. It's just a mistake, and it's something you're doing *now*. So the question is not: "How did the Absolute become the Universe?" That can't be answered. The Absolute has not become the Universe. The question is, "Why do we see it that way? Why do we feel that we are bound? Why do we continue to make this mistake? Why are we unable to see through the apparition?" And that can be answered.

On December 14th, 1882, Vijaykrishna Goswami asked Sri Ramakrishna this question: "Sir, why are we bound like this? Why don't we see God?" And Sri Ramakrishna answered:

"Maya is nothing but the egotism of the embodied soul. This egotism has covered everything like a veil. 'All troubles come to an end when the ego dies'. If, by the grace of God, a man but once realizes that he is not the doer, then he at once becomes a jivanmukta. Though living in the body, he is liberated; he has nothing else to fear."⁷

What Is Egotism?

So *maya*, the first cause, is made of three *gunas* and consists of seeing the Absolute through the screen of time, space, and causation--and we continue to see it thus because of egotism. *What is this egotism?*

Those of you who have read Erwin Schrödinger's little book, *What is Life?*⁸ may already see that egotism is a genetic invention to keep a living organism alive. The defining characteristic of a living organism is that it must be able to direct a stream of negative entropy upon itself. It must find and use a source of energy less scrambled at the start. Entropy is a measure of the scrambledness of the energy. Every living organism scrambles the energy in its environment. Negative entropy is a measure of the usability (the unscrambledness) of the energy. We get our negative entropy by eating and breathing. The plants get their negative entropy from the Sun. In most transformational processes, the scrambledness of the energy goes up. The entropy goes up. It never goes down. At least locally, entropy is going up; the Universe is running down. *Every living organism must direct a stream of negative entropy upon itself to stay alive; so life is impossible except in a situation that is going from bad to*

⁷ Nihilananda, Swami, tr. *The Gospel of Sri Ramakrishna*. New York: Ramakrishna-Vivekananda Center, 1942.

⁸ Schrödinger, Erwin. *What Is Life?*. Cambridge, Mass.: Cambridge University Press, 1967.

worse. If you want to enjoy the "good old days", do it now! *All living organisms live in this cascade of increasing entropy by directing streams of the increase through their forms. And egotism is a genetic invention required by this necessity.*

Prime Directives

The prime directives of the genetic programming are to direct a stream of negative entropy upon the organism and to pass on the genetic line. And the egotism required for the fulfillment of these prime directives is what Sri Ramakrishna referred to as the "unripe ego". The discrimination is made between the organism and its environment for the sake of fulfilling these directives. Sri Ramakrishna, when speaking to men, referred to these prime directives as "woman and gold"--"gold" for directing a stream of negative entropy upon the organism, and "woman" for passing on the genetic line. When speaking to women, he said "men and gold". He often said, when speaking to men, "*Maya is nothing but woman and gold.*"

Genetic Programming

It should be noted that this language--"genetic programming"--was not current in Sri Ramakrishna's day. So far as I know, some of the first things that were published on the subject of genetics were Mendel's experiments, and I don't think they hit the press until 1900. But if we translate Sri Ramakrishna's remarks into that language, they say very clearly that *maya is nothing but our genetic programming.*

You remember that the question was not how the Absolute has become the Universe, but rather why do we continue to see it that way. And the answer is that it is because of egotism, and that egotism turns out to be nothing but our genetic programming. It is this genetic expectation that keeps the wool pulled over our eyes. It is the expectation that by following the dictates of the genes we'll reach the peace and security of the changeless, the freedom of the infinite, and the bliss of the undivided. But that is just a genetic mirage.

We are programmed to eat, breathe, and mate. But not so fast! It goes in steps, and the male programming for passing on the genetic line goes like this: In the absence of females, seek females; in the presence of females, select. In the presence of a selected female, start a conversation. Ask her where she's from. Ask her where she's going. Ask her out to dinner. And the rest you know. We are all descended from ancestors who were programmed this way and who passed on the genetic line. So much for that problem. But how about our negative entropy?

Negative Entropy

We get our negative entropy by eating and breathing, and we get it from the plants. The plants get their negative entropy from the Sun. They make reducing agents for their own use, and dump oxygen out as waste. We munch down the reducing agents and huff and puff on the oxygen, and run around on the canned sunlight. And we feel that we are the doers. It's just a genetic mirage. We are not the doers. It is just recycled sunlight.

Sometimes when you read in *The Gospel of Sri Ramakrishna* that he says that we are not the doers, you might think that he is asking us to *pretend* that we are not the doers. No, he never makes that kind of mistake. He is not asking us to make-believe anything. He is asking us to discriminate between the real and the make-believe and to let the make-believe go.

I once wrote to Swami Yogeshananda that this earth can't bloom a flower. Without the Sun, no plants would bloom. Without the falling hydrogen, no suns would shine. And without the entire Universe, no hydrogen would fall. I said that this whole Universe blooms the flower: By this whole Universe, the robin sings. *But by what blooms this Universe?* It is the nature of the Absolute showing through in space and time that blooms this Universe. It is the revealing power of *maya*. The dream is in the dreamer, *and the dream is alive*.

So, it's the genetic programming that keeps the wool pulled over our eyes. But our genetic programming comes in batches, and that gives us a loophole--a genetic loophole. No other animal on the face of this planet has a childhood like yours.

Childhood

We have a whole batch of programming for being children, and another whole batch for being adults, and a third whole batch for being parents. But no one has a childhood like yours. And we owe our childhood to our parents. Directing a stream of negative entropy upon ourselves and on our children falls mostly to the parent batch. Passing on the genetic line falls mostly to the adult batch. But the children are free. Children do not direct streams of negative entropy upon themselves--"Mommy does it". And children don't pass on the genetic line--"Mommy does it". Children don't follow the prime directives. If you ask a child what he's going to do, he says, "I'm going to play. That's what kids do." As Sri Ramakrishna said, "The ego of a child is nothing like the ego of a grown-up man." You see, they both make sand castles at the beach; then the kids run through them with their feet, but the grown-ups take pictures.

The Beach

We owe our childhood to our sojourn on the beaches of north-east Africa, where we were probably marooned on an island a few million years ago, and where, in the absence of the jungle, we were forced to eat at the beach. It was there, when our body language failed in the surf, that we learned to talk. And it was there, to accommodate the change, that we prolonged our childhood.⁹ That is why our parenting batch is so different from that of other animals. And that is why the curiosity and the wonder of our childhood never comes to an end. We are the children of children who never grow up. And there is an escape route through this genetic loophole. Don't forget it! *Children don't follow the prime directives of the genetic programming*. And neither did Sri Ramakrishna. Although he practiced all sorts of spiritual practices, his native way to go was to think of himself as a child and of God as Mother.

⁹ Morgan, Elaine. *The Aquatic Ape*. New York:Stein and Day, 1982.

THE EQUATIONS OF MAYA

We have talked a little bit about equations and a great deal about *maya*. Now we have to take a hard look at our physics to see if any of our equations can be taken as descriptive of *maya*.

First of all, let me remind you that the physics of the last century--the physics of Swami Vivekananda's day--was nothing like the physics of this century. In those days it was taken for granted that the mix of the chemical elements in the Universe had been given at the time of creation--if there was a creation--or had been around forever--if there was a forever--and that if you just kept shuffling the mix long enough, it would come out in the present configuration again. The swami sometimes referred to that view. Don't take it as "gospel truth"; he is just quoting the scientific view of his day. In those days it was taken for granted that the Universe consists of real particles with real mass and real energy moving through real space in real time. It was taken for granted that mass and energy were different things, that space and time were independent of each other, and that if we knew the present position and momentum of the particles, we could predict the entire past and future of the Universe. No one thinks like that now. There have been some major revolutions in our understanding of physics since then, and they began just after Swami Vivekananda passed away.

Relativity

In the winter of 1895-96, Swami Vivekananda met Nikola Tesla and asked him if he could show that what we call matter is just potential energy. The swami said, "I am to go and see him next week to get this new mathematical demonstration,"¹⁰ which apparently never came. It is probably unfortunate that Tesla didn't get it shown, because if relativity theory had arisen out of a suggestion by Swami Vivekananda, the history of modern physics might have looked very different. The notion that what we see as matter is just potential energy was published as an appendix to Einstein's relativity paper ten years later, in 1905.

In 1905, Einstein changed our geometry from 3-D to 4-D. He put time into our geometry where it belongs. Time and space come into the geometry as a pair of opposites, so that if the space separation and the time separation between two events, say here-now and there-then, are equal, the total separation between those two events is zero.

Euclid assumed that space separations are objective, but Euclid's geometry is a theoretical geometry about a theoretical space that does not, in fact, exist. Space separations, and separations in time, are not objective. Observers moving with respect to each other measure different distances between there and here, and different times between then and now. What is objective is the *total* separation, the space-time separation, between there-then and here-now.

¹⁰ Vivekananda. Volume 5.

The equation looks very much like Pythagoras' equation for the hypotenuse of a right triangle. In Pythagoras' equation you square the two sides of the triangle, *add* the squares, and take the square root of that *sum*. But in Einstein's equation, to get the space-time separation between two events, you square the time separation and *subtract* it from the square of the space separation, and take the square root of that *difference*.¹¹ So that if the space and time separations between those two events are equal, the total separation between them is zero. And that puts the separation between the perceiver and the perceived at zero, because always we see events away from us in space by the trick of seeing them back in time in just such a way that the total separation is zero. That separation equation, as I see it, is one of the equations of *maya*. If this Universe is apparitional, like a dream, then the separation between the dreamer and the dream must be zero.

It was this change in the geometry that allowed Einstein to realize that what we see as mass (matter) is just potential energy. $E=mc^2$. That is the equation that Swami Vivekananda hoped to get from Tesla. So now we see that matter (mass), as well as energy, is just the underlying existence showing through in the apparition. So that equation, too, is an equation of *maya*¹².

There are many things which are easier to see now than they were in Einstein's day before the discovery of neutron stars and before the suspicion of black holes went public. It is easy to see now that the gravitational energy transformed to kinetic energy in the fall of an object to the surface of a neutron star would be a tenth of its rest mass, so that the energy released in the splash of a ten gram marshmallow on a neutron star would be enough to vaporize a town. It is easy to see now that, falling to the event horizon of a small black hole, one third of the energy would be released, and that all of it would be released if the black hole contained all the rest of the matter in the observable Universe. It is easy to see now that as Einstein said in 1917, "There can be no inertia relative to 'space', but only an inertia of masses relative to one another." And it is easy to see now that that inertia is related to their separation in the gravitational field, and not to their proximity to each other, as Einstein seems to have thought.¹³

It is easy to see now that the Universe is wound up against gravity because the undivided shows through in the separation. And it is easy to see now that the Universe is wound up against the electrical charges of the minuscule particles because the

11. $S^2 = x^2 - ct^2$, where x and y are the space and time separations between the two events, and S is the total space-time separation.

12 This equation is often written, $E=mc^2$, where c is the speed of light, 3×10^{10} cm./sec. In Einstein's day the unit for energy was the erg, and the unit for mass was the gram, and when we found out that mass and energy were the same thing, we had to know how many ergs make a gram. Now one gram is the energy of an atomic bomb, and one erg is the kinetic energy of a two gram beetle walking one centimeter per second. So $E=mc^2$ says that, carefully handled, the kinetic energy of 9×10^{20} two gram beetles walking one centimeter per second would vaporize Berkeley.

13 Gardner, Martin. *The Relativity Explosion*. New York: Vintage Books, 1976. Page 123.

infinite shows through in the smallness.¹⁴ And we owe a great deal of these considerations to Einstein. But there is another revolution that has taken place in our physics which is considered even more basic than Einstein's change in our geometry. That is quantum mechanics.

Quantum Mechanics

Matter does not behave according to our genetic expectations. Our genetic expectations are Newtonian. They assume Euclidean geometry, and they assume Newtonian physics. They take for granted that space separations are real, and that causation is transformational. That is why so many people have so much trouble "understanding" relativity and quantum mechanics. Our genetic expectations are offended. We cannot easily accept the fact that it is impossible to know everything about a physical system, just as it is impossible to identify the snake for which a rope has been mistaken. But there is this deep uncertainty lying at the bottom of our physics.

In the late 1920's, Werner Heisenberg pointed out that the product of our necessary uncertainty in where a particle is and our necessary uncertainty in its momentum can never be smaller than Planck's constant over two pi. Also that the product of our necessary uncertainty in when something happens and our necessary uncertainty in the energy of the happening can never be less than that same amount. This is Heisenberg's uncertainty principle, which I take to be another of the equations of *maya*. What it says is that if we see what we see through the screen of time and space, we cannot quite tell what it is that we see.

Richard Feynman has said that every statement in quantum mechanics is a restatement of Heisenberg's uncertainty principle. This quantum behavior is what keeps the electron from sitting down on the proton in a hydrogen atom, in spite of the enormous electrical attraction between them. If we knew that much about its position, our necessary uncertainty in its momentum would be so large that the momentum associated with that uncertainty would be enough to drive it off. That is why we don't fall through the floor. If the electrons are pushed too close to the nuclei, they simply buzz harder and keep us up. That's why the planets don't collapse. It's the uncertainty necessitated by the fact that the first cause of our physics is apparitional.

Summary

These three equations, as I see it, are some of the equations of *maya*. Einstein's separation equation sets the separation between the perceiver and the perceived at zero. *The dream is in the dreamer*. We see the bright star Sirius eight and a half light years away from us by the trick of seeing it eight and a half years ago. And the distance away comes in squared with a plus sign but the time ago comes in squared with a minus sign, so that if the two are equal, the total separation goes to zero.

¹⁴ Just as the gravitational energy of the Universe would go to zero if and only if the dividedness went to zero, just so, the electrical energy of an electrical particle would go to zero if and only if the size of that particle went to infinity.

Einstein's more famous equation, $E=mc^2$, "...In which energy is set equal to mass," is the equation which Swami Vivekananda had hoped to get from Tesla, because, as he said, "There cannot be two existences, only one." And Heisenberg's uncertainty principle includes the notion that the observer is always mixed up in what he sees. There is no longer any talk of a Universe independent of the observer any more than there is talk of an apparitional snake independent of the person who is seeing the apparition.

Whence and Whither?

For a long time I have felt that the physicists were just on the verge of noticing that the first cause of our physics is apparitional, that our physics is the physics of an apparitional Universe. I mentioned it to Johnny Carson when I was on his show a couple of years ago. I said that when you mistake a rope for a snake, what you do is to look at it very carefully, and you notice that it has these diagonal markings on its back. And you think, "It looks like a rope. Have we had ropes long enough for the snakes to imitate them?" And you call it a rope-snake. Then you look carefully at the end where the rattles should have been and you see hemp fibers. "Aha! Rope-snake hempii." There was so much laughter that I couldn't finish. We were cut off by the music. But what I wanted to say was that when you find that the head end is also hemp fibers, you realize that it really is a rope. I wanted to say that only this last step has not yet been taken by the physicists. Relativity and quantum mechanics are not about an actual Universe. We already have the physics of an apparition.

There are some interesting differences between the physicists and the mystics. The mystics take existence for granted, and want to get from here to there. They want to see beyond the apparition. And the physicists are likely to take non-existence for granted, and want to get from there to here. The Big Bang cosmologists want to get the Universe out of nothing. It's like asking us to believe that nothing made everything out of nothing. But that's not what shows in our physics. If behind what we see there were only a zero, then where would gravity come from, and electricity, and inertia? I have to side with the mystics. On observational grounds I have to take existence for granted.

Another interesting difference is that the physicists are Parinamavadins. They believe that causation is transformational and that the Universe is actual, whereas the mystics are Vivartavadins. Regardless of what they write in their books or what they say from the pulpit, all the mystics and religious aspirants agree that *faith is at the root of spiritual experience. And that would not be possible unless the Universe were apparitional.* If the milk has been made into buttermilk, faith that it's milk will be of no avail; whereas, if you have mistaken your friend for a ghost, faith that it's your friend ends the problem.

Here let me remind you that physics and philosophy are our maps. They can be judged as true or false according to whether they correspond or do not correspond to fact. But mysticism (or religion) is a journey, and about a journey one does not ask

whether it is true or false, but only where it goes. Will it take me to the goal?

Our problem is to reach the goal. To see beyond the screen. You remember that Swami Vivekananda said that the Universe is the Absolute seen through the screen of time, space, and causation. It's no use asking how the Absolute became the Universe. The Absolute has not become the Universe any more than the rope has become a snake. Our problem is to see it straight. And you remember that Sri Ramakrishna said that *maya* is nothing but the egotism of the embodied soul. And that is genetic. The prime directives of the genetic programming are to direct a stream of negative entropy upon ourselves and to pass on the genetic line. That is why we feel ourselves to be the doers of action and the enjoyers of its fruits. It is just a genetic mirage. The genes have us persuaded that by following their dictates we'll reach the peace of the changeless, the freedom of the infinite, and the bliss of the undivided. They don't have it to give. We don't get the undivided; we get a family. You must have noticed.

Our problem is to reach the goal, and *not be hoodwinked by the genes*. But this is not a journey from one place to another in an actual world. *It is a journey from one point of view to another*. That is why it is often referred to as an "inner journey". It is a journey from an erroneous point of view, dictated by the genes, to a point of view from which we can see through the genetic mirage.

Countercheating the Genes

It is important to remember that our problem is genetic. As James Burke says, "If you don't know how you got somewhere, you don't know where you are." And as I say, "If you don't know where you are, how will you know where to go?" In order to "countercheat" the genes, we need to know how they have cheated us.

In an apparitional Universe, seen in time and space, there are only three drives to catch hold of--the drive for the changeless which we see in matter as inertia, and in ourselves as our yearning for peace and security; the drive for the infinite which we see in matter as electricity, and in ourselves as our yearning for freedom; and the drive for the undivided which we see in matter as gravity, and in ourselves as our yearning for love and bliss. There are no other drives for the genes to catch hold of; so they have caught hold of these three and persuade us to run after them in ways that get their genetic necessities fulfilled, in ways that fulfill their prime directives. *But the fulfillment of a genetic necessity does not confer on the organism the fulfillment of the yearning that drives it*. The yearnings have been borrowed by the genes. But the genes have left some loopholes which we built in at the beach long ago.

All our spirituality began at that beach--our breath control, our speech, our music and our hymns, our worship, our mantras and our prayers. And there at the beach we built in parenting and childhood and the ability to pass on what we know. And now we are smart enough to countercheat the genes, to use the genes themselves to help us see behind the screen. Every human emotion can be redirected from the fulfillment of a genetic necessity to the fulfillment of our spiritual quest. And remember, our childhood

batch is unique; children don't go along with the prime directives of the genetic programming. "The ego of a child is nothing like the ego of a grown-up man."

And let me remind you that space is not that which separates the many, but that which *seems* to separate the one. And in that space that oneness shines, therefore falls whatever falls. And space is not that in which we see the small, but that in which the infinite appears as small. And in that space that vastness shines, therefore bursts whatever bursts, therefore shines whatever shines. And finally, time is not that in which we see the changing, but that in which the changeless seems to change. And in that time that changeless shines, therefore rests whatever rests, therefore coasts whatever coasts.

Swami Vivekananda said that science and religion would meet and shake hands. I think that time has come

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