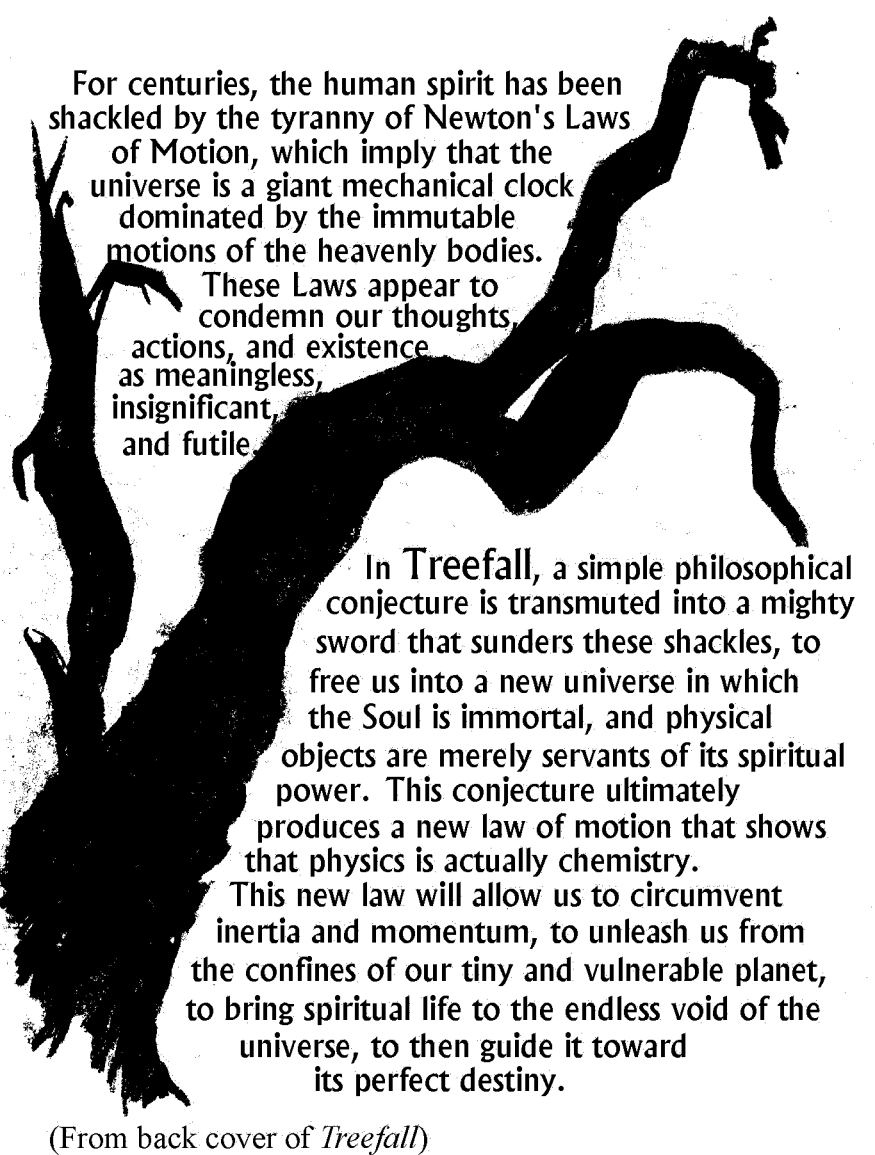


Treefall



John Hansen



For centuries, the human spirit has been shackled by the tyranny of Newton's Laws of Motion, which imply that the universe is a giant mechanical clock dominated by the immutable motions of the heavenly bodies.

These Laws appear to condemn our thoughts, actions, and existence as meaningless, insignificant, and futile.

In *Treefall*, a simple philosophical conjecture is transmuted into a mighty sword that sunders these shackles, to free us into a new universe in which the Soul is immortal, and physical objects are merely servants of its spiritual power. This conjecture ultimately produces a new law of motion that shows that physics is actually chemistry. This new law will allow us to circumvent inertia and momentum, to unleash us from the confines of our tiny and vulnerable planet, to bring spiritual life to the endless void of the universe, to then guide it toward its perfect destiny.

(From back cover of *Treefall*)

Treefall is a philosophy that journeys from a single fundamental axiom toward explanations of the questions of human existence as well as the paradoxes of physics. When I first completed the journey and looked back, what I saw was so strange that I thought it had to be wrong. But time has passed since then, and I now feel that anything, no matter how strange it seems, that can answer so many questions and resolve so many paradoxes, must be fundamentally correct. If it is, the approaching Millennium will be extremely interesting.

~ John Hansen

(Text from inside front cover)

-----Many of the answers were totally new to me, and outrageously strange. So strange, that if I had not previously resolved to approach them with the mind of a child, I would have immediately abandoned them. Instead, I stayed with them, and let them unfold like a flower.

-----Our bodies are therefore nothing but non-judgmental observing machines that exist within the three-dimensional world, interfaced with our memories and Souls, which both exist in another dimension.

-----So come with me to where the ground is wet. To see the unfolded flower, beside the fallen tree. Please look at it, with the mind of a child, as da Vinci would.

From the Preface of Treefall

(Text from inside back cover)

TREEFALL

John Hansen

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*We are here to abet creation and to witness it,
to notice each other's beautiful face and complex nature
so that creation need not play to an empty house.*

-Annie Dillard

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Preface

"When a tree falls in a deserted forest, does it make a sound?" is one of the world's most widely known philosophical conundrums. Each of us probably confronted it at a tender age and may have attempted to resolve it. One approach to its resolution is to carefully define your terms. If a sound is vibrations in the air, then the falling tree makes a sound. If a sound is the result of what happens in your brain after the vibrations rattle your eardrums, then the falling tree does not make a sound unless there is a brain to interpret the vibrations of the air. But this does not really resolve anything. If the sound requires a brain, how close must the brain be to the tree, and does it have to be paying attention? Could the brain be on another continent? Another planet? Another galaxy? If the brain were trying very hard to hear the falling tree, is there any way that it could be prevented from hearing it?

For me, this conundrum has never been resolved. Ever since I first heard it as a child, it has remained like a mirage in the desert, shimmering in mystery. Long ago, I became convinced that a complete resolution of this conundrum would simultaneously answer all questions about the universe. Unfortunately, the philosophical questions embodied by the falling tree have been abandoned by philosophers as irrelevant and without substance. It raises the central idea that it somehow matters whether or not an event is observed. If its being observed is important, then the Observer is also important. The philosophical idea that

the observation of something somehow makes an important contribution to the Reality of its existence reached its apogee among the eighteenth-century British empiricists, led by George Berkeley. Their arguments supporting this idea did not prevail, and it was tossed on the trash-heap of philosophical history. Whereas philosophers tend to let discarded ideas languish forever, the concept that observations and Observers are important is being resurrected by physicists who do quantum-mechanical experiments on photons passing through slits. Much to their great interest, the photons behave differently when they are observed than when they are not observed. These physicists are forced to conclude that the making of observations has an impact on what constitutes Reality.

My greatest heroes are Thomas Jefferson and Leonardo da Vinci. Jefferson because of the astonishing diversity of his interests and accomplishments, and how his life was a monument to the difference that can be made by a single individual. Da Vinci because he was unencumbered by conventional thinking. He interpreted his experiences on their own terms and did not filter them through prevailing ideas. When he saw birds floating through the air, he concluded that something was holding them up and were thus immersed in some kind of fluid. His peers scoffed, asserting that the air was ephemeral nothingness. We wonder at how blind they were. Did they never feel the wind? We laugh and congratulate ourselves that we have climbed out of blindness to always see clearly and to understand all things. Well, many things. The human mind is still an unfathomable wonder to us, and we still have to go to church to find a place where we are comfortable with exploring our Souls and to cope with what will happen to our Souls when we die. Perhaps when the answers to these and other great questions are finally known, we will be

slack-jawed with amazement at our blindness; in that the clues to the true nature of things were embodied in everything around us. It was their familiar simplicity that prevented us from recognizing their significance, just as the familiar breeze on the faces of da Vinci's peers failed to awaken them to the Reality of the air as a substantial fluid.

I think da Vinci's ability to rise above conventional thinking was not due merely to his genius, but to his ability to approach things with the mind of a child, unencumbered by preconceived ideas. Unlike a child, da Vinci knew the preconceived ideas, because they were imposed on him by his teachers. But he was able to set them aside and not let them impede him from traveling down paths opened by fresh thoughts. I think all of us have fresh thoughts. But we do not pursue them because we either assume that someone else has already thought them, or we discover that they do not conform to conventional thinking, so we abandon them. The long history of human thought and the edifice of scientific knowledge intimidate all who embark on new roads that lead to solutions of old conundrums.

I am convinced that the answers to the great questions surround us in abundance, and that you could reach in nearly any direction to grab them. Therefore, it does not really matter where you begin or what you grab. But it is like digging for water. Although it is said that water lies everywhere under the earth, it is much easier to find if you dig in some places than in others, and a good place to dig is where the ground is wet. If you want to answer the great questions, you should look for the equivalent of a wet place, and I think I have found it in the tree that falls in the forest. About eight years ago, I became committed to the idea that the answers to the great questions are indeed embodied in the falling tree, and that if I could just approach these ideas with the mind of a child, like da Vinci would, I could grasp

them and draw them out. Using da Vinci as an inspiration, I was determined that I would not abandon an idea just because it clashed with conventional thinking. Nor would I worry whether someone else had thought of it before.

The first stage in the extraction process required converting the conundrum of the sound of the falling tree into something more fundamental. This is similar to the scientist who looks for the proper model system. Suppose you want to study how a rabbit jumps. The brute-force approach is to study jumping rabbits. A well-established scientific technique is to look for a model system that embodies the qualities of jumping rabbits, but is simpler and more convenient. So you might study grasshoppers instead, because grasshoppers possess all the muscles, joints, and nerves required for jumping but are otherwise much simpler than rabbits; and they are abundant, cheap, and not so cute. To study really fundamental aspects of the rabbit's jumping, such as where the energy to jump comes from, you might even study bacteria. The choice of a proper model system is often the crucial thing that determines success or failure in solving a scientific problem, so careful consideration must go into it.

There are many things implied by the question of whether a tree that falls in a deserted forest makes a sound. One is that the participation of an Observer is important. Another is that the perspective of the Observer is important. Is it possible for the tree to fall in a place that is so isolated from Observers, that its sound cannot be heard, no matter how carefully the Observers are listening? I decided that the answer to this is "no," and that it is impossible for the sound of the falling tree to be completely cut off from the surrounding universe. Therefore, if one listens very carefully and cannot hear a falling tree, then no tree is falling. A general way of stating this conclusion is that if

something cannot be observed, then it doesn't exist.

"That which cannot be observed does not exist" accordingly became the embodiment of the philosophical questions raised by the falling tree, and constitutes the model system that I subjected to philosophical contemplation. If the answers to the great questions are hidden in the falling tree, then it should be possible to answer them by exploring the ramifications of the idea that if something cannot be observed, it doesn't exist. I contemplated these ramifications over a period of seven years during idle moments. I was surprised to discover how robust the idea was, and how easily it led to answers to the "great questions." Many of the answers were totally new to me, and outrageously strange. So strange, that if I had not previously resolved to approach them with the mind of a child and to set conventional thinking aside, I would have immediately abandoned them. Instead, I stayed with them, and let them unfold like a flower. It turned out to be a flower filled with such wonder and beauty, that I simply didn't care that it negated all of the beliefs that I had previously held. I found that I yearned for the new beliefs that the lessons of the flower taught, because they so ennobled the human spirit, imbued our existence with great purpose, and pointed toward solutions to all our problems.

As the ideas grew in complexity, I decided that it would be necessary to write them down just to organize them. After seven years of contemplation, the writing did not take long; with Part I being written in one month followed by a five-month break, and Parts II-IV being written in two months. Part I develops the philosophical context of "that which cannot be observed does not exist," and shows that the nature of the universe is consistent with its needing to have Observers in order to exist, and that humans are ideally suited as Observers. This has the exhilarating effect

of providing us with a purpose for existence, tells us how to distinguish between good and evil, and points toward a natural moral code.

However, just because the universe seems to be very carefully arranged to accommodate Observers does not prove that they are essential to its existence. Part H establishes the physical basis by which the observing of something has an impact on its Reality, and that when something is observed, especially by an entity with neurons, it becomes more intensely real than when it is unobserved. This link between observations and Reality draws upon Quantum Mechanics and the wave nature of matter, and asserts that when a neuron observes something, it contributes its metabolic energy to intensify the waveform of what it is observing, through resonance. The intensification of Reality caused by these resonant observations is recognized as a new force of Nature, and it is suggested that this force is responsible for much of the organization that we see in the universe, including that of the heavenly bodies, as well as the tendency of living things to become increasingly organized and complex through evolution. Part II also arrives at the startling conclusion that the motion of objects is actually a chemical reaction, which points to a new universal law of motion and effortlessly explains many heretofore unfathomable conundrums of physics, such as the origin of inertia and momentum and the dual nature of light. It also presents the astonishing idea that the means by which we move our bodies is psychokinesis, which is achieved by a process in which Observations trigger our neurons to catalyze a translocation reaction that results in the conversion of selected muscle cells from a relaxed state to a contracted state. The Free-Will ability of organisms to move their bodies in response to an internal decision-making process is recognized as the only mechanism by which

the universe can have access to more than one destiny. This may be very important, and unless Observers learn how to exercise Free Will to appropriately alter the otherwise-immutable course of the universe, it may be doomed.

Part III delves into the metaphysical ramifications of "that which cannot be observed does not exist" and addresses questions of the nature of our Souls and of consciousness. It recognizes that we are entities that exist in Time as well as in three-dimensional space. The idea unfolds that the mind is completely unlike a computer, but more like a musical instrument, and that our actions are not dictated by computer-like calculations, but by resonant responses. The truly astonishing idea emerges that our memories are not actually stored in our heads, but reside in another dimension, and that we access these memories by a process that involves a brain-mediated resonance between the Present and the Past. The Soul is seen as an entity that regulates the process of memory storage and recall by serving as a resonance-modulating gateway between these two dimensions of Time. The body and Soul exist in a symbiotic relationship, in which the Soul provides the judgment and decision-making capabilities necessary for the body to protect itself from harm; the body provides the energy that is necessary to make Observations and to allow the Soul to evolve and improve. This relegates the brain to being nothing but a collection of resonators, and is thus not a container of our experiences, nor the container of the Soul, nor does it possess any part of the essence of our Being. Those are all in the other dimension. In this context, the Soul is like the conductor of an orchestra in that it is constantly searching our memories for the most harmonious resonant response to circumstances that our bodies encounter, moment by moment. These resonant responses constitute decisions that are communicated to the body, which are implemented

by means of neurons catalyzing the chemical reaction of motion within muscle cells. Our bodies are therefore nothing but nonjudgmental observing machines that exist within the three-dimensional world, and these observing machines are interfaced with our memories and Souls, which both exist in another dimension. This implies that our familiar existence in the Present is really a Virtual Reality experience, and that our "true home" is the other dimension. When our bodies die, the Virtual Reality link is broken, and our Souls, which are immortal, are simply released from their engagement with the three-dimensional Present to then become aware of that dimension in which they actually are. It is proposed that while our Souls are isolated in that dimension, they are in a better position to assess things than when they are interfaced with a material body. This larger perspective provides access to an understanding of the greater purposes of human existence that can only be achieved by a process that requires Souls to move back and forth between dimensions, in which they become interfaced with material bodies over and over, to live a sequence of many lifetimes. Although explicit memories of its past lives are lost as a Soul is interfaced with a body, it retains an intuitive understanding of its greater purposes, which include a constant search toward self-perfection, as well as to fulfill the duty of Observers to guide the universe toward its perfect destiny.

Part IV considers that the force toward Reality that has resulted in the evolution of Observers on earth has been at work everywhere since the dawn of the universe, so there must be other Observers. Some of them may have evolved long before us, so they have had much more time to assess the significance of the cycle of Souls between dimensions and have figured out the crucial role that Observers have in the destiny of the universe. They also know that the motion

of objects is a chemical reaction, and that neurons are capable of catalyzing this reaction. They will have used this knowledge to fabricate large artificial neurons that can catalyze the chemical reaction of motion of large objects, and thus cause their space ships to move around by means of psychic forces. The catalytic process circumvents inertia and momentum, and so allows instantaneous acceleration, deceleration, and changes in direction. Understanding how to control this process is the key to space travel.

When they visit our planet, the alien Observers can easily tell that we do not possess this understanding, nor do we have an explicit understanding of the purposes of human existence. So they will ignore us until we succeed in learning these things. As we do so, we can expect that we will develop a profound understanding of the existence of the other dimension that is so important to us. This will have a profound effect on the future evolution of the human spirit. We will come to truly understand ourselves and our relationship to the universe and the profoundly important role that we must learn to play long before its twilight is upon us. As that time approaches, we will learn how to shape destiny and to become the conductor of the greatest orchestra that is possible. And as we approach the end of the symphony of the universe, we can contemplate the nature of its perfect final chord. To play it perfectly, each Soul must become a perfect instrument that is able to divine the perfect moment to play the perfect chord; as we all play it in perfect harmony, its perfect beauty will be our Salvation.

Is it possible for the falling tree to say all this? I do not know if the tree will speak to others as it has spoken to me. So come with me, to where the ground is wet. To see the unfolded flower, beside the fallen tree. Please look at it, with the mind of a child, as da Vinci would.

John Hansen: May, 1996

Prologue

A Tree Falls in the Forest

It was a small island in the South Pacific Ocean, with a tropical forest at its center. The day was hot and still, but as the sun set, ominous clouds gathered on the horizon. Shortly after darkness fell, the wind began to blow and the rains came. The wind blew harder and harder. The tropical forest was lashed mercilessly by the wind and rain, and the tall trees swayed back and forth, their roots straining at the ground. The storm lashed the forest for hours, until one great tree, the tallest and most majestic in the forest, finally succumbed to its brutal force. The soggy ground around its roots gave way, and with a loud ripping and tearing, the great tree began to topple into the forest. It fell slowly at first, then faster and faster. As it fell, its limbs, which were intertwined with limbs of surrounding trees, were snapped and shattered into woody shrapnel. Finally, after a huge struggle between the forces of life and the force of gravity, the mighty tree crashed to the ground, striking with such force that its trunk sank deeply into the rain-drenched soil, which groaned as it made way for the violent intruder. Finally, all was still. But despite the enormous turmoil caused by the fall of the mighty tree, it bothered no one. Because no one, absolutely no one, was there to hear it.

Observers Find The Tree

The following morning dawned bright and clear. About mid-morning a jaunty yacht appeared on the horizon and sailed toward the deserted island. It moored a few yards off shore, and several men disembarked with heavy packs and boxes. Out of them came elaborate equipment, which they proceeded to set up with great care. They prepared a meal, and while they worked, they were attentive to their surroundings and frequently looked in the direction of the forest. They saw and remarked upon, every bird in the air and pointed toward every small animal that appeared at the edge of the forest. They noticed every insect that crawled on the ground. They ate while gathered in a tight circle and talked among themselves in an earnest and serious manner. Finally, about mid-afternoon, they carefully gathered up their equipment and moved into the tropical forest. Nothing escaped their attention. They noted every tree, every rock, every plant, as they proceeded slowly through the forest. They took pictures of everything, and their notebooks filled up with the data they were gathering.

In the course of time, they came upon the mighty fallen tree. They were quite excited by the discovery and swarmed over and around it, peering and poking everywhere. They pointed to the many branches that had been snapped and broken during the fall, and shook their heads in awe when they saw how deeply the trunk was embedded in the ground. Several of them examined the great root-ball that had been wrenched from the ground. They looked at the sky, and appeared a little concerned that another great storm might come. They studied the tree and its surroundings for a long time, but eventually their curiosity was satisfied, and they prepared to leave. They all gathered near the huge root-ball of the fallen tree and

gazed down the length of the fallen trunk. They looked up, and in the eyes of their minds, imagined what the mighty tree must have been like before it fell. They imagined the awesome forces of the wind that were required to wrench its roots from the ground, and imagined its cataclysmic descent into the forest, breaking and snapping branches as it went. They imagined the violent impact that would be required to drive it deeply into its final resting place. One of them shook his head and said deliberately, "Boy! When this thing fell last night, it made one hell of a noise!" All of his companions nodded thoughtfully in agreement.

The Tree and the Universe

As the Observers looked at the tree embedded in the ground, they thought about the moment it smote the earth, like a hammer against a cymbal, and how the ground reverberated like a cymbal, and the waves of the reverberations radiated outward from the center of their creation. The entire tropical island resonated with the reverberations of the cymbal, and the oceans resonated with the island, and the continents with all their cities and people listening resonated with the oceans, and the earth resonated with the continents and wobbled in its orbit around the sun, and the sun resonated with these wobbles, and all the planets resonated with the wobbles of the earth and the sun, and the new wobbles of the solar system emanated into the greater universe like the ripples created by a rock tossed into a pond, whereupon the entire galaxy resonated with these ripples and sent the message on until the entire universe resonated with the sound of the falling tree.

The tree fell during this storm instead of during a different storm, because of where it had grown and when its

seed had been planted, which was by a bird that had paused on a branch with a seed in its beak. The bird had flown from tree to tree and from branch to branch. It dropped the seed where it did because of choices it had made up to the moment of dropping, and could just as well have dropped the seed at another spot, in obedience to a different whim. The seed in another spot would have fared better or worse, and the tree that would have sprouted would have fared differently. This different tree would likely have fallen at a different time in a different storm, and would have smote the cymbal of the earth in a different place in a different way. The ripples that would have been set loose upon the universe would have emanated from this different center, and the universe would have resonated in a different way. The universe that resulted from the one seed would thus be different from the other, and would be headed toward a different Destiny. It is sobering to think that a little bird, flitting from branch to branch, dropping a seed at a time and place of its own choosing, can have such awesome power.

Part I

The Philosophy of Observation

For a philosophy to be meaningful, it must acknowledge the empirical world.

What follows is a philosophy. The discipline of philosophy proposes that it is possible to prove or disprove the existence of God by constructing a logical argument from fundamental axioms. It is expected that any philosophy that can achieve this will be sufficiently robust to answer other vexing questions about human existence, such as who we are, what our role in the universe is, and how to distinguish good from evil. The fact that no philosophy has yet succeeded in doing these in a satisfying way does not preclude its possibility, nor should it deter us from trying to develop such a philosophy.

In this century, much has become possible that was impossible before. This is a consequence of our having studied the natural world and discovering many of the rules by which it operates. Physicists have studied matter and learned how the building blocks of matter interact with each other to assemble into atoms, and the forces that are involved. They have utilized the insights and skills developed by mathematicians to do this. Chemists have studied how atoms are assembled into molecules, and the properties of these molecules. Biologists and biochemists have tried to explain how the phenomena we associate with life are derived from molecules. Cosmologists study the structure of the universe and use the tools of Mathematics, Physics, and Chemistry to determine its origin and eventual fate.

This knowledge of the universe is essential to philoso-

phy. Albert Einstein said, "Through purely logical thinking, we can attain no knowledge of the empirical world." This means that until sufficient empirical knowledge is available, no meaningful philosophy is possible. It also says that it is impossible to derive a philosophy by means of pure reason. Consider that an infinite number of distinct universes are possible, each one with a unique set of natural laws. The philosophy of each type of universe would have to be derived within the context of its natural laws, and the fundamental axioms of the philosophy would necessarily reflect these. It makes no sense to attempt to set down axioms for a philosophy without first studying the natural laws of the universe for which the philosophy is intended to apply.

These natural laws could be subtle and complex, and it could take a great deal of time and a great deal of effort before enough could be learned about these natural laws for it to be possible to formulate philosophical axioms that embody them in an appropriate way. With this in mind, it is important to realize that a large portion of what we know of the natural world has been acquired very recently. This new knowledge gives access to philosophies that were previously impossible to formulate.

In order for something to be highly complex, it must be based on something simple.

Several years ago, an intriguing idea occurred to me. I had just read Stephen Hawking's *A Brief History of Time*. As I put it aside, I couldn't avoid the feeling that for the first time in history there might be sufficient empirical knowledge about the universe to formulate a philosophy that works. I felt that this philosophy would have to be built from a simple foundation. I mean simple in the sense that the most

complex thing in the universe we know of is a living organism, and the logic of its existence is based on a language consisting of just 20 amino acids, whose sequences are defined by the genetic code which has only four letters. The computer, with its binary logic based on just two letters consisting of on and off, is capable of performing feats of prodigious complexity. Taking this argument to its limit says that the ultimate complexity, which is the universe itself, might rest on a base of a single fundamental law.

To argue that the universe is controlled by a single fundamental law, suppose the universe had many fundamental laws that all had to be obeyed simultaneously. If each law were independent unto itself, constructed totally without regard to any of the other laws, then it is inevitable that they would eventually clash into an irresolvable conflict. We see this with the United States Constitution, which has some articles that cannot be reconciled with all the other articles, even though some very clever minds did their best to prevent this. There is only one way that a Constitution could be written so that there cannot be conflict among its articles, and that's if there is only one article. Similarly, the only way a universe could be constructed and be absolutely certain there are no conflicts among its laws is that there be only One Law. This implies that everything about the universe is a logical consequence of that One Law being played out. If we were to study such a universe, it would appear to possess many laws, and to identify the one fundamental law upon which all the others rest; this could be very difficult.

From Descartes to Relativity, the role of the Observer.

Having considered this thought, I wondered what this

One Law might be. I decided that anything this important and this fundamental had already been discovered a long time ago. It just had not been accorded any precedence over other non-fundamental laws, which have also been discovered in abundance. It had probably already been chewed over by philosophers, maybe even spat out and discarded. Then I remembered a college course in modern philosophy that I took. It started with Rene Descartes and went forward. The ideas of philosopher after philosopher were put up, and shot down. As we came into the modern age, it appeared that the goal of philosophy, which is to understand God and the universe by means of human logic, was unattainable. When we got to the end of the semester, the professor said something that impressed me a great deal. I can't remember his exact words, but they were something like this: "When you get down to it, the only philosophical principle put forth that everyone agrees is absolutely unassailable is Descartes' dictum, 'I think, therefore I am: "

Although this may be the only unassailable philosophical principle that we know, it must not be the One Law, because if it were, Descartes would probably have succeeded in the development of a complete philosophy, and he did not. There must be something else. So I thought about the knowledge we have available to us that Descartes did not have. Maybe this knowledge is essential to allow us to recognize the One Law. Thinking about the great achievements in discovery between Descartes and the present, probably the only thing that could not be dreamt in his philosophy is what is put forth in Relativity and Quantum Mechanics. Suppose Descartes was very close to the answer, but he couldn't get it because he was missing a crucial piece of the puzzle that these theories provide. Perhaps that puzzle piece is one that states that the properties of objects cannot be defined except in reference to an Observer.

It was Einstein's Theory of Relativity together with other important ideas that were developed around the same time, such as Quantum Mechanics, the dual nature of light, and Heisenberg's Uncertainty Principle, that asserted the properties of objects, such as their velocity, mass, and location, cannot be defined except in relation to an Observer. This is counter to intuition, which suggests that the location, mass, and velocity of an object are absolute properties that exist irrespective of whether anyone attempts to determine what they are. Most people assume these theories imply that an object, such as a car sitting motionless at the curb in front of your house, actually has an exact location and particular mass, but they are uncertain because attempts to measure them inevitably change them; it is not that absolute values do not exist, we are just foiled in our attempts to determine them. On the contrary, the Uncertainty Principle is actually saying that exact values of both the location and the mass of your car at a given instant are not only impossible to determine, but **DO NOT EXIST!** Moreover, for either the mass or location to be defined, the participation of an Observer is **REQUIRED!**

Richard Feynman (Nobel Prize, physics) has pointed out that we have learned how to use these theories for useful things like making atomic power plants and constructing electrical circuits, but we simply do not understand them. One of the most elusive aspects is the role of the Observer. Physicists are upset by the logical consequences of these theories, which suggest that objects are not fully defined until they are observed. This has led to the strange paradoxes, including the famous Paradox of Schrodinger's cat, which suggests that a cat can be both alive and dead simultaneously until someone checks to see, whereupon the cat becomes either the one or the other. Paradoxes such as these are more than opportunities for lively conversation

over a few beers. They are truly unresolved questions that cause great concern among physicists, but do not alarm ordinary people because they are not aware of how help-less physicists are in resolving the philosophical implications of these theories.

I wondered how Descartes and philosophers since Descartes might have incorporated the role of the Observer into their philosophies if they had known about these theories. Again and again, the idea emerges that existence and observation are intertwined. There is probably no philosophical question more widely known than the tree falling in a deserted forest. You could go into the most degraded and drug-infested crime-slum in the country and grab someone at random, and discover that he or she knows of this question, and would probably have already thought up his own answer to it, and would probably think you are extremely stupid for not knowing the answer to this stupid question.

As I contemplated *A Brief History of Time* together with the paradoxes of Quantum Mechanics and the falling tree, a vague concept coalesced. Very roughly, the concept means that if you can't observe something, no matter how hard you try or what means you employ, then it doesn't exist. On the one hand, it seems simplistic. If you can't detect something, no matter how hard you try, then even if it were there, it wouldn't matter to you. On the other hand, it seems profound. Suppose that you can't tell something is there, no matter how hard you try. And I mean really try. You think there may be a tree in the forest, so you go charging into the forest looking for the tree, and you look high and low for it, and use every conceivable method to find it. You exhaust every idea by every scientist, spend billions and billions of dollars looking for the tree, and can't find it. You dig up the entire forest and put it through a sieve

and can't find it. And that is just the beginning of what you do to find the tree. There would come a point where you would conclude that the tree doesn't exist. And the only way you could arrive at this conclusion is because you have been unable to observe it, no matter how hard you tried, and no matter what means you employed. Prior to your having done this, the fact of its non-existence was uncertain, but now that you have done it, its non-existence has become highly certain. Conversely, suppose you had found the tree. At that point, the tree's existence would become certain. Although it is clearly open to philosophical debate, it appears that our participation in determining the tree's existence is a crucial factor that determines whether it exists or does not exist.

Suddenly, we are very important, and if this idea is applicable to the tree, it is applicable to everything else. If so, then we have an extremely important role in the universe, which is to act as Observers. In the role of Observers, we observe things, and for some reason, their existence would not be possible if we did not observe them. It follows that if we were not around to make observations, the existence of the universe would not be possible.

I juggled the idea in a variety of ways, searching for the simplest and most appropriate way to express it. This resulted in its being formulated in the negative, because the positive version-which would be something like, "in order to exist, a thing must be observed"-didn't seem quite right. It accordingly came out as: **That Which Cannot Be Observed Does Not Exist.**

I have to admit that at first glance, it doesn't look like much, or even original. If you found it in a fortune cookie you would toss it out without a thought. As I had anticipated, it is indeed an idea that had been scrutinized and rejected by early philosophers. For example, the eigh-

teenth-century British empiricists, led by George Berkeley, were very concerned about what was happening to something when you weren't looking at it. His fundamental dictum was, "To be is to be perceived," which suggests that when we are not looking at something it isn't there. Many reasonable people took exception to the idea that if you glanced away from something, it would cease to exist. Ronald Knox penned a limerick that ridiculed this idea:

There once was a man who said, "God
Must think it exceedingly odd
If he finds that this tree
Continues to be
When there's no one about in the Quad."

In rebuttal, it was suggested that when we were not looking at things, they did not cease to exist, because God was looking at them. The limerick was then extended to include this idea:

"Dear Sir, your astonishment's odd,
For I'm always about in the Quad;
And that's why the tree,
Continues to be,"
Signed, "Yours faithfully, God."

The rebuttal failed to adequately deflect the ridicule, and the attacks on the credibility of the idea caused it to be abandoned and to become little but an amusing footnote in philosophical history.

When it comes to the falling tree, one can attempt to resolve the conundrum by carefully defining what you mean by sound. If a sound is vibrations of the air, then the falling tree unquestionably makes a sound. However, if you choose to define a sound as something that results

when your brain receives the signal sent by your ears in response to the air's vibrations, the question becomes more complex. It is at this point that most people become very impatient with the whole conundrum and disdainfully distance themselves from it, as it being unworthy of serious thought.

However, it becomes very worthy of serious thought when one realizes that the falling tree reaches toward the concept that observation and existence are intertwined. If observation and existence are truly intertwined, then it should be possible to build a philosophy on this foundation. I have thought through many of the implications of "that which cannot be observed does not exist," and I have been surprised at how robust it is; and how easily it reaches toward answers to the great questions. What follows are the discoveries I have made. Anyone can look at my conclusions and judge whether they have been arrived at by a logical path. You can experiment with your own line of reasoning and see what kinds of conclusions you obtain.

There are, of course, certain questions that cannot be answered through the exercise of logic. For example, one cannot expect a logical argument to predict a correct answer to the question, "What color of leaves should trees have?" The correct answer depends on many things, such as the fundamental physical laws of the universe, but also such things as the wavelengths of light that our sun produces, the season of the year, and other factors. A tree on another planet, under a different sun, could well have leaves that are not green. In another universe, with a different set of fundamental laws, the concept of a tree might not have any meaning at all. We clearly need to combine philosophical logic with empirical discovery in order to arrive at answers to many, if not most, questions. Biochemists who have studied plants can give you a very good

account of what it is that makes leaves green and can give good arguments about why green leaves are a good thing in the context of our own planet. During the course of empirical discovery, one usually begins with very little data and can think up many different ways to explain it. As empirical discovery of new data proceeds, the number of explanations that can accommodate all the observations drops. Eventually, in instances where empirical discovery has proceeded extensively, there may be only one explanation that anyone can think of that can accommodate everything. Such all-accommodating explanations are called "Laws."

Let us apply the axiom "that which cannot be observed does not exist," to the tree that has fallen in the forest. The Prologue presented the argument that when it falls, it indeed makes a sound whether there is anyone around to hear it or not. Trained Observers such as scientists with sensitive equipment can arrive after the tree has fallen and gather convincing evidence of the tree's fall and the racket that it must have made. Moreover, the reverberations of the tree hitting the ground resonate to the far reaches of the universe, and anyone who wants to listen can hear it fall. This is the one side of the coin, which says any event that occurs in the universe never occurs in absolute isolation, but in one way or another, communicates with the rest of the universe to leave an imprint of its occurrence.

We now need to examine the other side of the coin and consider the possibility of something occurring in such isolation that no communication with the rest of the universe is possible. This is quite different from something that we do not notice or cannot detect. As I sit here, my body is bombarded by radio and television broadcasts that create absolutely no physical sensation. Suppose I knew nothing

about the existence of such broadcasts. Since I cannot perceive them, I could reasonably deny their existence. Since you know about these things, you can say, "You are so stupid. Just because you aren't aware of something doesn't mean it doesn't exist" You proceed to turn on your television and radio and give me a lecture on electromagnetic waves. I am now convinced that they exist because I have observed them. But what of something that exists, but we don't know how to detect it? Scientists run into this problem all the time. Physicists spend billions of dollars building machines to detect subatomic particles whose existence they merely suspect. They have a very good record of finding them once they start looking, but what of ones that they do not suspect? Whenever they start looking for a particle, there is always a reason to suspect it exists; either some aspect of their theoretical mathematical equations predicts a particle, or there is some experimental result that can only be explained by some heretofore undiscovered particle. But what if nobody ever worked out equations or did experiments? We would know nothing of these particles. If we don't know about them and can't detect them, do they qualify as having existence?

One answer to this is that all subatomic particles contribute to the material substance of the universe, and even though we don't know about them, their presence is manifested in everyday occurrences that we observe all the time. It is like grains of sand on the beach. Even though we can only see the ones lying on the surface, what we see is affected by the grains below the surface. If you took these lower grains away, the top grains would fall downward. The fact that the surface of the beach does not sink downward shows us that the lower grains are there. Although we cannot observe them directly, we observe them indirectly because of their effects on the grains that we can see. The

lower grains therefore do not qualify as something we cannot observe, even though we cannot see them and don't realize that we are observing them.

So what I am interested in thinking about is, what if something is truly not observable, even indirectly? This is where we need to turn to Quantum Mechanics, which argues that physical objects cannot have defined physical properties in the absence of an Observer. Most physicists agree that this is the case, and Einstein has been virtually alone in resisting this notion by asserting "God doesn't play dice with the universe," even though his Relativity theory contributed to the dilemma in the first place.

It is rather astonishing that physicists have been confronted by these paradoxes for nearly a century and have made little progress in resolving them. They spend most of their time going into rooms and sitting down at tables and asking each other over and over, "Can this really be true? Have we missed something? Let's think about this some more and go over it again." They go over it again and again, and come to the same paradoxical conclusions. So they go back out and do other things like look for more subatomic particles, or scrutinize more faint smudges in the sky in order to obtain better estimates of the age and size of the universe, hoping that something will come up to resolve these paradoxes.

Resolution of the paradox of Schrodinger's cat.

Let us now review the circumstances surrounding the paradox of Erwin Schrodinger's cat, and I will show how it can be resolved. Schrodinger proposed that we place a cat inside a sealed box that contains a bottle of poison and a mechanical hammer that can break the bottle, release the

poison, and kill the cat. The hammer is activated by a trigger device that will trigger the hammer to break the bottle in response to a random event, such as the decay of radioactive material. We wait for a period of time such that the probability of the radioactive material having given off a particle, thus killing the cat, is about 50:50. We don't know which it is until we open the box and observe either the living cat or the dead cat. Schrodinger was concerned that Quantum Mechanics and the Uncertainty Principle asserted that in the absence of an Observer, nothing can have a precisely defined existence. This implies that until we open the box to observe the cat, the question as to whether the cat is alive or dead is unresolved and it therefore possesses qualities of being both alive and dead simultaneously! Many reasonable people agree that it is impossible for the cat to be simultaneously alive and dead, and it is this fact that causes them to suspect there is some-how a flaw in the fundamental principles of Quantum Mechanics, or at least in our understanding of them.

This paradox can be resolved by the following reasoning. In order for the situation proposed by Schrodinger to be relevant to the real world, it cannot in any way violate natural laws. A fundamental premise of the paradox is that you cannot know whether the cat is alive or dead until you open the box. I will argue that it is impossible to design a box in such a way that would prevent a determined Observer from determining whether the cat is alive or dead unless the box is opened.

To illustrate this, suppose we design the experiment in the following way: We use a nice big box, about five feet tall, and place it on an extremely sensitive scale. The scale is hooked up to a recording device so that any changes in pressure on the scale can be readily observed and documented. The box has a ladder in it, which reaches toward

the ceiling of the box. Suspended from the ceiling is a delectable piece of fish that can only be reached by climbing the ladder.

Before we begin the experiment, we feed the cat and wait until it falls asleep, whereupon we gently place the cat in the bottom of the box and close the lid.

For the sake of illustration, suppose we have set up two identical experiments, each with its own cat, box, scale, recording device, and Observer.

After we have waited for a period of time such that there is a 50:50 chance that the cat in one of the boxes has been killed, then there is an equal 50:50 chance that the cat in the other box has not been killed. Let us assume that this is indeed the case, and that the cat in the first box is alive, and the one in the second box is dead. According to Shrodinger's assumptions as set out in his paradox, the only way to determine which box is which would be to open them up and look. Clearly, our experimenters do not have to do this.

Consider what the experimenter who is observing the data output from the first box would see. The cat, who was initially asleep, would eventually wake up. Although it had been fed, it would eventually get hungry and begin looking for food. It would smell the fish and eventually figure out how to climb the ladder to get it. Cats are loathe to climb down from things that they have climbed up, so it would eventually jump down. Some cats might eat the fish while clinging to the top of the ladder. Other cats might prefer to eat the fish after they had jumped back down, but that doesn't really matter.

The moment that the cat wakes up, the pen that was recording the variations in pressure on the scale would begin to jiggle. The experimenter for the first box might say to the second experimenter, "I think my cat is waking up."

The cat might wander around the bottom of the box for awhile but would eventually begin to climb the ladder seeking the delectable piece of fish. The oscillations of the pen would undoubtedly take on a very different character, and if the experimenter had done this kind of experiment many times before, he would probably recognize the changes in the oscillations as the tell-tale signs of a cat climbing a ladder. After watching for a while, the experimenter for the first box might say to the second experimenter, "It looks like my cat has decided to eat the fish while sitting on the top of the ladder." A short time later, as the pen made more jiggles in a pattern that the experimenter recognizes, he says, "Now she's cleaning her whiskers."

Suddenly, the recording pen jumps to the top of the chart. "She's jumped down," says the first experimenter to the second experimenter.

The second experimenter watches the events unfolding with the first box, and looks at the unmoving recording pen attached to her own box with anguished concern.

"I'm really afraid the cat in my box is dead;" she intones. This was very upsetting to her, because she liked cats a lot, and the cat in her box had been a very pretty and friendly cat. This had happened before, and she was really considering getting into another line of work.

"Let's watch a while longer, and see what else happens," said the first experimenter, who was distressed to see her concern.

They continue their vigil for several hours. The pen oscillations from the first box continue steadily, but slow greatly from time to time. During one of these slow times, the first experimenter says, "She must be asleep right now. I see two superimposed families of oscillations. One has a period that corresponds to the known breathing rate of a

sleeping cat, and the other to that of a heartbeat."

Conversely, the recording chart in front of his colleague, whose face was now quite bereft, showed nothing.

"I really think he's dead," he says to her.

"Can we be sure?" she said. "I just can't leave here without knowing for absolutely certain. Maybe my scale is broken or something," she adds.

The first experimenter thinks for a while, and then brightens. "I know what we can do. We can take the temperature of the two boxes with a very sensitive thermometer. Any cat that is alive gives off body heat, which would radiate to the walls of the box and warm it up. If the temperature of my box is higher than the temperature of your box, then that will show that your cat is dead."

He goes to get a thermometer and attaches it to the side of his box. It is a recording thermometer, and they both watch while the pen rises and levels off.

He then removes the thermometer from his box and attaches it to her box.

She then wrings her hands in anguish as she watches the pen drop down to a distinctly lower temperature. Grasping at straws, she says, "Maybe you broke the thermometer when you yanked it off your box and slapped it onto my box."

Although he took great pride in his skills, he gently responds with, "I'll re-attach it to my box and check it again." Neither of them is surprised to see the pen go up again, to level off at exactly the same temperature as before.

Although she did not ask him to, he then moves the thermometer back to her box, whereupon the pen drops again to the lower temperature. He does this several more times, moving the thermometer back and forth between his box and her box, each time getting the same high tempera-

ture with his box and the same low temperature with her box.

Whereupon she gently presses her hand against his arm and says softly, "Thank you, but that's enough. It's just no use."

It is time to go home. They put all their equipment away and clean everything up. Just before turning off the recorder for his box, the first experimenter notices that the pen is jiggling quite a bit. "Looks like she's awake." He goes over to his box, opens the lid, and stands aside as the cat jumps out. Then the second experimenter goes over and stands in front of her box, not wanting to open it. She looks one last time at its recording devices. Nothing.

She proceeds to open the box knowing what she would find, although hoping for a miracle. She raises the lid, stands up on her tiptoes, and peers in. She catches her breath.

There he is, lying quietly beside the broken poison bottle. He is still very pretty. But he isn't friendly anymore. Because he is dead.

Someone who wanted to argue that Schrodinger's paradox is not resolved by this might assert that we could put the cat into a box that prevents the vibrations of the cat's movements and the heat of the cat's body from getting out where we can observe them. This is impossible. We could build a box that can reduce the signals from the box, but they cannot be eliminated entirely. There is no material substance that can completely stop the flow of heat, and it can travel through a vacuum by radiation. When the cat jumps down from the ladder, the changes in momentum when it lands are inevitable, and their effects may be dampened, but not eliminated. One can push this a little farther by noting that the cat's beating heart involves motion, and

this motion will affect the gravity field around the cat. Nothing is impenetrable to gravity, so these effects could be detected with a sufficiently sensitive device. It seems that the universe is designed in a way that, if a thing exists, it is impossible to prevent it from being observed in some way, either directly or indirectly, by a determined Observer. It follows that if there is something that cannot be observed, then it doesn't exist.

Is the design of the universe consistent with a requirement for Observers?

If "that which cannot be observed does not exist" is true, the fact that the universe exists shows that it has Observers. Humans would seem to qualify as being Observers. However, the fact that Observers exist in the universe does not prove that the universe cannot exist unless Observers are present. One could state that "All dogs must have fleas." The fact that you find a dog with fleas does not prove the statement.

One thing we can do is see if the universe is designed in such a way that is consistent with its needing Observers. Especially telling would be to look closely at any strange and bizarre properties that the universe has. If these bizarre properties are consistent with the universe needing to have Observers, this would be an argument in favor of Observers being required. If there were lots of such properties and they were indeed very strange, then the argument would be even stronger. So let us look at some of the strange properties of the universe in this light.

If the universe needs Observers in order to exist, then this is true all of the time, not just part of the time. All of the time means that Observers are needed at the very begin-

ning of the universe, as well as during its existence, and at its end.

You may be inclined to say, "Well, you can stop right there. If we are the Observers, we have just recently appeared on the scene. We weren't around at the beginning of the universe, so we certainly didn't observe it." You could proceed to point out, "There couldn't have been any other Observers either, because there is lots of evidence that the universe began as a Big Bang, consisting of pure energy that evolved into matter which then evolved into galaxies and star systems. The universe consisted of almost nothing but hydrogen and helium for millions of years. It was only within the intense temperature and pressure of the stars that these evolved into the heavier elements, including the elements required for life, mainly carbon, oxygen, and metals. Several cycles of the births and deaths of stars, each spanning millions or billions of years, were required to form sufficient quantities of these elements to support the formation of planets. Once formed, a planet such as our own seems to have evolved life within a billion years. Our planet is now about 4.5 billion years old, and it is only very recently that humans have been up and about."

Finally, you could say you "admit that humans are now going everywhere and looking into everything, and generally making observations like crazy. But there was just no way that we could have gotten into the observation business any sooner, considering that the evolution of life can only occur on a planet with an elemental composition that can support life, and that a planet such as ours is not possible without several galactic cycles of the births and deaths of stars. The existence of Observers at the beginning was just impossible."

I'm glad you have taken that attitude, because it makes my job easier. Suppose I were to explain to you that the uni-

verse has some very strange properties. And these properties are just what are needed to allow Observers such as humans who have just arrived on the scene, to actually and literally observe the birth of the universe *at the time it was actually happening*. I admit that this could be a total coincidence. But the fact that it is true cannot help but cause us to take the idea of the universe needing to have Observers in order to exist more seriously. Suppose I were to then present you with other really, really strange properties of the universe; properties that seem outrageously strange, quite opposite to conventional wisdom and reason. And that these, too, are consistent with the universe needing to have Observers in order to exist. Perhaps your conviction that this is a crazy idea would begin to falter. Perhaps your conviction would collapse. Let us proceed to look at these strange properties.

Some Very Strange Properties of the Universe that Are Consistent with Its Needing Observers.

Nearly everyone has heard that one of the bizarre consequences of Relativity is that, as a mass is accelerated faster and faster toward the speed of light, its mass gets greater and greater, and that if it could achieve the speed of light, it would have infinite mass. Another surprising aspect of this process is that as the object approaches the speed of light, its time frame slows down, and it ages more slowly. Science fiction writers have had a great time writing stories in which space voyagers venture out at high velocities and return to find themselves much younger than their families and friends. Scientists have sent super-accurate atomic clocks into space, recovered them, and found that they have indeed run slower than identical clocks that

remained on earth. People get so hung up about how amazing it is that we would actually age more slowly, and actually live "longer" although we would not realize it, that they fail to notice the really important thing about this phenomenon, which is that as you approach the speed of light, time gets slower and slower and if you could attain the speed of light, time would stop completely. We instinctively turn away from this possibility, because we realize that the speed of light is a limit that our physiological bodies can only approach but never attain. However, massless particles of light, or photons, do travel at the speed of light. It is therefore quite literally true that for a photon traveling through empty space, time does not pass at all.

For photons, time stands still.

To show what this means, suppose you are sitting in your chair watching television and a commercial comes on. At that very moment, a photon leaves the sun and heads toward the earth. It takes about nine minutes to get here, and during those nine minutes you have an opportunity to do quite a few things, such as go to the kitchen to fix a ham sandwich and open a beer. Nine minutes later, having eaten your sandwich and drunk your beer, you glance out the window, and the photon that began its journey when you were sitting in your chair hits your retina, and it occurs to you that it is a nice sunny day. Although from your perspective, nine minutes passed between the time that the photon departed from the sun and the time it hit your eye, from the perspective of the photon, the moment it struck your eye was exactly the same moment that it left the sun. This is because the photon was traveling at the speed of light, when time stands still.

Now apply this idea to when you look up at the stars at night, and see objects that are thousands, millions, and even billions of light years away. When a photon that originated from a galaxy that is a billion light years away began its journey a billion years ago, life on earth consisted of primitive forms drifting in the sea. However, from the moment of its departure to the moment of its arrival at your eye, from the relativistic perspective of the photon, not a single instant has passed since it left its galaxy a billion years ago. It is our instinct to ask, which of these two time frames is correct, since they cannot both be right. Well they are. For you, a billion years have passed. For the photon, not an instant has passed. This is a truly bizarre state of affairs, and it has the truly amazing effect of enabling us to *observe the birth of the universe, at the time it actually happened.*

To examine this concept further, let us examine some of the current theories about the birth of the universe. Physicists and cosmologists are pretty much agreed that the universe began as a Big Bang, in which all the substance of the universe was created literally from nothing. It began as something much smaller than a proton, which then inflated and exploded. At some point between the beginning of inflation and the explosion, the primordial particles of the universe, quarks and so on, coalesced into existence. All of this occurred during a time-frame that was much smaller than a second, and the universe has been expanding steadily ever since. The violence of this explosion was incredible, and everything went flying out in all directions some bits going faster than others. Some of the bits were going really fast, and everything expanded outward to form a sphere of ever-increasing size. The outer edge of the sphere is defined by the bits and pieces that are going the fastest, and these are moving at nearly the speed of light.

Since nothing can go faster than light, it is not meaningful to ask what lies outside the expanding boundary, since to go there and look would require an Observer to race fast enough to catch up to the edge and go past it. This would require going faster than light, which is impossible in our relativistic universe.

We know that this expansion has been occurring for something like 8 to 20 billion years, the actual value being dependent on the Hubble constant, which is tricky to measure. Amazingly, the combined efforts of mathematicians, physicists, astronomers, and cosmologists, some of whom have been making empirical observations about what is out there in the universe, and others who have been developing theories to account for these observations, have been able to extrapolate backward from the present time, to provide detailed insight about exactly what must have happened during the very earliest instants of the universe. There is almost no controversy about what has happened after the first second, and very little controversy about almost all of the last part of the first second. What is up for grabs now is what happened during the teensiest first part of the first second.

The answers to what actually happened are now being sought by looking at the actual Big Bang itself. Incredibly, this is possible because that expanding edge of the universe contains objects that are so far away from us that the photons that we see coming from there began their journey shortly after the Big Bang. We have been trying very hard to see these photons. There is the COBE experiment, which has mapped the background radiation of the universe in exquisite detail, and has provided a physical picture of the distribution of mass and energy in the primordial universe. There is also the Hubble Space Telescope, which has been capturing as many of these photons as possible which are

Doppler-shifted to become very dim and red to allow us to figure out exactly what was happening during the earliest moments after the Big Bang. Of course, the very initial instant of the Big Bang is not available. Photons from that instant would be infinitely dim and infinitely red and cannot be observed.

However, we can aspire to study that first instant by extrapolation backward from what we can see. Scientists are used to doing this, and they have much confidence that knowledge gained from extrapolation is completely valid, as long as you have enough data points so that your extrapolation is aimed in precisely the right direction. This takes lots of measurements, and the more we take, the more accurate our extrapolation becomes. This says that as we continue our observations of the expanding universe over an extended period of time, we can expect to approach closer and closer to a perfect description of the events of the Big Bang. It is like the scientists studying the evidence around a fallen tree. If they spend enough time and are clever about what observations they make and how they make them, they can come to a better and better description of exactly how and where and when the tree fell. They might find, under the fallen tree, a partially opened flower of a species that is known to open only at a particular brightness of the morning, and could use this information to fix the time of day that it fell. When it fell, it might have killed a nearby tree, and from its rings they could determine the year. From a study of the distribution of pollen grains embedded in its bark, they could determine the season of the year. Measurements of relative amounts of certain atomic isotopes in leaves from the tree could even provide information about the temperature at the time the tree died. And so on. There is of course no way that we can go back and actually observe the event of the fall, but by

studying the evidence resulting from the consequences of the fall, we can reconstruct the events of the fall as accurately as we please. So it is with the beginning of the observed universe.

Scientists have been in the process of doing this for quite some time now, and the principles on which such observations are possible are so well established that it is easy to stop thinking about the fact that it is really incredible that the universe is created in such a way that it is possible for us, who have arrived on the scene many billions of years after the beginning of the universe, to study its very beginning at the time it was actually happening. Remember that those dim red photons we are studying, that have been traveling for billions of years from our point of view, are actually, from their point of view, arriving here at the very instant they departed from near the cataclysmic center of the primordial universe. That the universe could contrive a way to be simultaneously very old and very young is quite amazing. It is a perfectly elegant solution to the problem of how to create a universe with Observers in it that are able to observe that universe throughout its existence, from its very beginning. And now that we are here, it is our task to observe it until its very end.

If the universe must have Observers, what are they like?

If the universe is designed so that it requires Observers that can observe the universe throughout its entire existence, it must also possess natural laws that make it highly probable that appropriate Observers will indeed appear at the appropriate time. Let us consider what kinds of qualities these Observers would need to

have. First of all, the Observers would need an intense, innate desire to make observations and would need to be sufficiently intelligent to implement an advanced technology. Technology is needed because the Observers must perform observations of the larger universe throughout the rest of its existence as well as look back into time to observe the universe coming into being. The latter requires observations of very dim red photons coming from the expanding edge of the universe. The ability to capture sufficient numbers of these requires the construction of large and highly sophisticated optical devices. If the Observers are on a planet with a turbulent atmosphere, it would be necessary to develop a technology that could lift the optical devices into space where they could obtain an unobstructed view.

The desire to do these things would be so strong that the Observers would attempt to do them as soon as possible after discovering the scientific principles that would make them possible. A study of the history of the Observers would therefore show that the discovery of the principles of flight would be followed by development of space-worthy vehicles within a remarkably short period of time. Rapid implementation of this technology would be extremely expensive, and would place a considerable burden on the collection of Observers. The Observers themselves might not know why they are doing this, because the desire to observe would be an instinctive biological need. They could even question the wisdom of expending their wealth in this way, but they would do it anyway. Their innate compulsion to observe would find outlets in many ways. Prior to the development of advanced technology, they would employ whatever means possible to explore their environment. They would endeavor to find and examine every accessible part of their planet. As technology developed, they would

press it into service as rapidly as possible to extend their observations. Once they had discovered how to fashion devices that would allow them to cross over water, they would embark on journeys of discovery long before they had learned to make the devices safe to use.

When these explorations under dangerous circumstances led to pain and death among their members, they might question the wisdom of what they were doing, but they would do it anyway. Explorers and discoverers would be held in exalted esteem, and stories about their exploits would be honored and recounted with pride. As soon as the means for writing was developed, these stories would be the very first things to be recorded into documents, and no Observer could be considered educated unless he knew the details that were set forth therein. The greatest heroes of any age would be those who pushed the hardest and the farthest into the unknown. If explorers that embarked on a perilous journey did not return, others would not rest until their fate had been determined. Their remains would be sought. The circumstances of their final moments would be investigated. There would be a desire to use this information so that the next mission would be successful. New explorers would go out as soon as possible.

They would go everywhere they possibly could-into the deepest part of the water, and up onto the highest bit of land. As they looked up into the heavens, they would wonder about the stars. The cleverest among the Observers would invent optical devices to get a closer look at them, and as soon as they discovered what stars were, they would desire to go there to explore new worlds, and to go where no one has gone before. If one were to ask these Observers why they were doing these things, they might not be able to come up with a rational answer. They might say something like, "because they are there," and get on

with their explorations and observations.

To be sure, it would be better over the long term if the Observers knew what they were doing and why they were doing it. If it is true that Observers are needed in order for the universe to maintain a defined existence, the universe must be kept under unbroken observational surveillance from its beginning to its end. Whereas the Observers can reach backward through time by peering toward the edge of the universe, the only way to observe the future is to wait for it to happen. All of the current cosmological theories suggest that our universe is considerably less than halfway to its demise in old age. Since current estimates of the age of the universe range from about 8 to 20 billion years, the Observers are in the throes of a daunting task, which is to maintain an unbroken vigil for the billions of years from now until the end of the universe.

It seems unlikely that an innate desire expressed only in terms of a craving biological need is enough to keep things on an even keel for these billions of years. A person who is dying because of a lack of vitamin C will develop profound cravings, but may uselessly attempt to requite them by eating a donut instead of a piece of fruit. It is easy to imagine how the cravings for exploration and discovery could find less desirable outlets that interfere with or prevent observational accomplishments. For example, the craving that would drive an explorer into the danger of the unknown could be transmuted into a willingness to participate in battles and wars. Heroic status that would ordinarily befit those who braved the dangers of discovery would instead go to those who braved the dangers of battle.

One can imagine a really unfortunate scenario in which all the intellect and wealth that was being expended on making discoveries and observations would instead be shunted into supporting hostile actions. The worst-case

scenario would be one in which these actions led to the extinction of the Observers, since this would cause the extinction of the universe. One would hope that the Observers would come to their senses before the ultimate disaster had come upon them, but they might not.

It seems that the only solution to prevent this from happening is for the Observers to come to understand their purpose and role in the universe. In the absence of understanding, they might believe that their existence is of such little consequence that the possibility of their being extinguished is of no concern to the larger universe and that their passing would go unnoticed. If they do get embroiled in battles and wars, they might get so disgusted with themselves that they would regard total self-destruction as a good thing. On the other hand, if they were to realize the significance of their existence, and that their role in the universe was actually of crucial and central importance, they would probably abandon their hostilities and attempt to devise political and moral structures that would make survival through the endless ages possible. We would see space exploration in a new light, because our earth will perish long before the end of the universe, so we need to move off the earth to places where observations can continue in safety.

One can only speculate what such political and moral structures would be like, but there are some features that they would be sure to possess. The mind, the intellect, our senses, and the ability to use these to experience and interpret our surroundings would be held with great reverence, both with respect to oneself and those of others. These must be used with the greatest possible honesty and integrity; to observe one thing and report that you observed another would be an abhorrent thing to do. Institutions that contribute to stability and continuity would be

held in very high regard. Being a member of a family, to learn as a child and to nurture and teach as a parent, to transmit knowledge and values would be a sacred duty and trust. Professions that involved exploration and discovery would be respected and esteemed, and this respect would be extended to everyone who performed roles that strengthened and contributed to the ability to carry out these tasks. Any deed that could be seen to enhance and advance these things would be regarded as good. Any deed that provided an impediment would be regarded as bad or evil.

A Natural Moral Code

We are beginning to see that the Philosophy of Observation can fulfill one of the fundamental purposes of philosophy, which is to develop a logical way to distinguish Right from Wrong, and Good from Evil. This is important, because we have traditionally depended on religion to do this. Unfortunately, many people in the modern age have deserted their religious traditions, or have at least lost confidence in them. As they lose confidence in their religious traditions, they also lose confidence in their teachings about how we are to behave. The fear of hell and damnation is largely gone, and those who perform good works often do so because they have been raised in good families that have taught good values. But different societies have widely different values, and it is very hard to tell whose values are inherently right and whose are inherently wrong. If the philosophy derived from "that which cannot be observed does not exist" is worth anything, then it should point us in the direction of good moral values.

Centuries ago, when Christianity had its grip on the

population, people's religious beliefs tended to guide them in virtuous directions. We were taught that we were made in the image of God, and that we were God's primary interest and concern. The earth was the center of the universe, and we were the most important thing on the earth. When things were going badly for us, God cared so much for us that he sacrificed his Son to set us back on the path to righteousness. If we were good, we would go to heaven. If we were bad, we would go to hell. Heaven was really, really wonderful. And hell was really, really awful.

And then Copernicus discovered that the earth goes around the sun. No more center of the universe for us. Galileo pointed his telescope to the heavens and discovered that many of the ethereal bodies were actually nothing but big rocks. Time passed, and things got worse and worse. Now we see that our Earth is nothing but a little planet going around an ordinary sun, located on an arm of an ordinary galaxy. One of billions and billions of other galaxies. We seem as insignificant as grains of sand underneath a rock on a deserted beach, or in the desert, or at the bottom of the sea. No wonder we try to bring significance into our lives by making a lot of money, and buying a big house, and getting an important job, and living in a powerful country that wins its wars, and doing things that appear to be significant. It's hard to take yourself seriously when we are as insignificant as grains of sand on a deserted beach, or in the desert, or at the bottom of the sea. The Catholic bishops knew this was going to happen, and they tried to stop Copernicus and Galileo from telling what they had discovered. But they couldn't stop them, and now we have a crisis of confidence in which it seems that what we do is of absolutely no consequence whatsoever. Why try to do good if nothing you do matters in the long run?

But suppose "that which cannot be observed does not

exist" is true, and we are the Observers that make the existence of the universe possible? Suddenly everything is completely different. We are insignificant no longer. So what if our planet is tiny and our galaxy ordinary? If it weren't for us the universe wouldn't exist. And if we don't survive, the universe will cease to exist. The fact that the universe profoundly needs us and is constructed in such a way that needs us, then it shows that we are doing a task that even God can't do! Maybe God somehow created the universe, but for some reason Observers are needed to achieve its purposes. God apparently doesn't even know how to be an Observer! "Move aside God, and let us do the job that you can't do!"

The Ten Commandments tell us how to behave, but not why. "That which cannot be observed does not exist" teaches us how to behave, and also teaches us why. It starts by telling us who we are. We are Observers. It tells us our purpose. We are to observe. If this is our purpose, we must be constantly vigilant to never worship other idols by way of allowing ourselves or anyone else to subvert our talents and abilities to make observations in order to pursue other ends, such as wealth, or power, or domination. We also learn why we should not bear false witness, which is because the making of observations is a sacred purpose that is a collective effort of all Observers, and the universe exists as a totality of these observations. This totality is weakened by lies, and for an Observer to observe one thing and report another is a grievous wrong. To report false observations about another Observer is particularly grievous. The reason we should not kill is because every Observer is on a sacred mission. To kill an Observer and thus destroy the capability of performing that mission is a reprehensible act that subverts the stability of the universe. The reason we should neither steal nor commit adultery is

because the fulfillment of our purpose requires making uninterrupted observations until the end of the universe. This will require great stability of human institutions. Stealing represents an assault on the stability of civil institutions, which are necessary to maintain social order. Adultery represents an assault on the stability of the family, which is and will continue to be the primary means of transmitting moral values through the countless generations before us. In order to be able to make observations under difficult circumstances and to report them accurately, an Observer must cultivate self-reliance and personal responsibility so our sustenance and possessions should be a result of our own efforts. We must also build strong and responsible relationships with other Observers; relationships that will last over a long period of time. This is why we must not covet another's spouse and property, because to do so represents a desire to take short-cuts toward possessions and relationships that we do not deserve because they did not result from our own self-reliance and personal responsibility. The desire to take these short-cuts should be resisted. We even learn why we should recognize a Sabbath and rest. Although performing observations is a sacred purpose, it cannot be allowed to consume all your efforts because it will be destructive to this purpose in the long run. There is much more to making observations than just recording events. Mechanical devices can do that. An essential component of making observations is the use of the intellect for making interpretations and inferences about what is observed. This is a slow process that requires the mind to be in a reflective mood. We therefore need to take some time out from actively making observations, and to relax and to reflect on the meaning of what we have observed. We should do this at least once a week.

How the Universe Began and How It Will End

As described above, cosmologists are fairly agreed that the universe originated in the Big Bang. This involved inflation from an infinitesimal point, called a singularity, in which the gravity and density are so enormous that the laws of physics break down. Upon inflation, which involved cooling and coalescing of the intense energy of the singularity into fundamental particles, our universe came into existence. It seems likely that the transition from a singularity to a universe could happen in many different ways, each of which would establish a universe with a distinct set of physical laws. For any universe to come into being, it must have a set of natural laws that makes its existence possible. Although it is conceivable that many different combinations of physical laws could achieve a stable universe, our own universe has apparently adopted the requirement for Observers, and we have seen that our universe has many bizarre properties that are consistent with its needing Observers. The question arises, How does a universe "know" that it possesses a set of laws that permits its existence, and therefore comes into being? One possibility is that an infinite number of universes are created, most of which cannot exist and are extinguished at the instant of creation. Thus, only those universes whose existence is possible would persist.

Our universe appears to be one that is destined to persist, but perhaps not. One of the very strange properties of our universe is that it is simultaneously very old and just created, which is what makes our observation of its creation possible. Since it is at the instant of creation that the laws of the universe are established, it is this instant that determines whether a universe possesses laws that allow it to persist. The fact that our universe has an aspect to it that

is forever at the instant of creation, in the sense that we can observe it and study it during the actual time of its creation, means that the question of whether the laws of our universe permit its persistence has not yet been fully resolved, and will never be fully resolved until the universe comes to the natural end of its existence.

If an infinite number of universes were created, many of them would be almost identical to our own, except for differences in one or more tiny details. It is in these tiny details that a fatal flaw might lurk, whose consequences would grow with time, causing the universe in which they occur to become unstable and cease to exist. Our universe could be one of these doomed universes, and just because things seem to be going along reasonably well up to now, there is no guarantee that they will continue to go this way forever. Indeed, the fact that there could be an infinite number of ways that a universe could be created that is almost, but not quite, consistent with persistent existence suggests that the probability of our being in a universe that has got-ten everything just right is infinitesimally small. If we are in such a flawed universe, then we are doomed.

How the Universe "Knows" It Can Exist

I see at least one way out of this dilemma. Instead of universes being created in infinite numbers with an infinite range of natural laws, there could be some mechanism to select only those whose physical laws make true existence highly probable. In this scenario, any particular universe would have to have some way of "knowing" whether it possesses a set of laws that is consistent with existence, and if it does, then it can come into existence. Cosmologists tell us that the universe has three possible fates, and the one

that will actually occur is determined by the amount of mass our universe contains. Since we do not know exactly how much mass there is, we do not know which of these fates is in store for us. If we can determine this mass, we will know.

There is a certain critical mass such that, if the universe has less than this, it will continue to expand forever. If it is greater than this critical mass, the gravity exerted *by* this mass will eventually bring expansion of the universe to a halt, whereupon the expansion of the universe will reverse into a contraction and collapse back toward the center where it will end in a "Big Crunch," which is like the Big Bang, but in mirror form. The third possibility would occur if the amount of mass in the universe is precisely equal to the critical mass that marks the dividing point between eternal expansion and contraction, and if the universe has precisely this mass, it will continue to expand forever, but toward a definite limit that it will approach in an asymptotic manner.

Let us consider the possibility that the universe is destined to end in a Big Crunch. Although this seems to be a bleak prospect, it is in this scenario that the problem of how the universe "knows" it can exist can be resolved. As has been noted before, the Big Bang starts with what is called a singularity, wherein all the laws of physics have no meaning. The Big Crunch would end in a similar singularity, whereupon all the laws of physics that the universe had possessed during its lifetime would break down. Physicists and cosmologists agree that the singularity is a place we can never go; it is eternally inaccessible to us. These singularities thus constitute a kind of wall, and what goes on beyond that wall is forever unknown to us; and the laws by which things operate on the other side of the wall of the singularity are completely unconstrained by the laws that

we see on our side of the wall. Although we see the beginning of the universe as separated from the end of the universe by an enormous gulf of time, that might not be true on the other side of the wall of the singularity. For all we know, on the other side of the wall, the universe that is beginning and the universe that is ending may exist in a simultaneous time-frame. Thus, the universe at its beginning could "see" the universe at its end, thus establishing that existence of the universe from the beginning to its end is possible. Perhaps the only universes that can come into existence are those that have both a beginning and an end, so it is only those universes that will come into existence and expand outside the singularity to appear on this side of the wall as a real universe. Some might wish to invoke a supreme being on the other side of the wall, who would arbitrate which universes come into being. However, if He is on the other side of the wall, then it would seem that He cannot simultaneously be on this side of the wall. And even if He is, He cannot perform the role of an Observer. It is hard to see how a Being that is incapable of making Observations in our universe can be an all-powerful God.

High probability is not the same as certainty.

Let us assume for the moment that this scenario is correct, and explore some of its implications. The fact that our universe displays both a beginning and an end on the other side of the wall does not necessarily mean that it is completely certain that our universe on this side of the wall will persist from beginning to end. Everything about our universe rests on probabilities, never certainties. With this in mind, the fact that our universe possesses both a beginning and an end on the other side of the wall must merely mean

that it is highly probable that our universe will persist from beginning to end on this side of the wall. As we all know, even very high probabilities do not amount to certainties. No matter how much you know about a horse, you can never be certain that it will win.

We are perhaps in the situation of an aspiring knight, who consulted a diviner prior to his journey forth. The diviner said to him, "You have admirable qualities; you are smart, you are clever, you are strong, you are persistent. You have ideals and you want to do good. But you will meet with great adversity. You will discover that you have many weaknesses, and you will be tempted to stray from the path that you know is right. You will encounter situations that will appear hopeless, and you will be tempted to give up and allow yourself to perish. You will be presented with many choices, some of which will lead to success; and others that will lead to doom. In order to succeed, you will be required to fight and give your all; any less, and you will fail. You will have great doubts. However, in all of this, remember that you are of noble birth. Your qualities are not an accident. In the face of hopeless adversity, think of this and know that somewhere within you is the strength that is required for you to prevail. It will not come without effort, but it is there. Learn to know yourself; your weaknesses and limitations as well as your strengths. Learn to use all these qualities in your quest. If you do this, you are almost certain to succeed."

The thing to focus on here is that one may have the qualities that will allow one to succeed, but if these qualities are not properly implemented, one will fail. It is likely that we are in this situation as Observers of the universe. We have the qualities that are required for us to maintain our observational vigil from the beginning of the universe to its end. It is highly probable that these qualities will

enable us to do this. But it is not certain. If our noble purpose is deflected by attractions to that which is ignoble; then the universe, with all its promise and all our accomplishments, will cease to exist. Not only to cease to exist from now and forever after, but to cease to have ever been. The reason it would cease to have ever been is because of that component of our universe that is forever at the instant of creation, and it is at this instant that the question of its persistence of existence is resolved. Therefore, if our universe were to cease to exist, it would cease at this instant of creation; and all other aspects of the universe would simultaneously cease to exist at this same instant. Since it ceases to exist at the moment of creation, anything that happened after this moment would be relegated to nothing. It is bleak to think that if we should falter in our task to observe the universe until its end, all of our accomplishments up to the moment of faltering would not be merely forgotten, but cease to having been accomplished; all of our experiences would cease from having been experienced. To be forgotten is one thing. To never having even existed is quite another. This makes the stakes of continuing our vigil to the bitter end extremely high.

The door at the end of the universe.

Now that we have developed these ideas, let's use them to tell a story. This is not a true story, because it is about the end of the universe and we are so far from it, and we have so many observations to make before we can zero in on it, that it is impossible to have a clear idea about what it will be like. We do not even know whether it will expand forever or collapse in a crunch. But we can amuse ourselves by thinking about what it might be like if it does end in a crunch.

Because of the noble qualities required of Observers, we can hope that there will be some very hardy Souls who will manage to be vigilant until the bitter end. One would expect that between now and then, the population of Observers would have grown enormously and occupied many worlds. Over the course of time, the universe would have expanded, reached its maximum and begun to contract. The galaxies and stars would have continued through their evolutionary processes, and the matter of the universe would have been largely converted into energy. The number of habitable worlds would have decreased greatly, so the number of Observers that could be supported would also be decreased greatly. Those that remained will have come to thoroughly know and understand the nature of the universe and their role in it, and that carrying out observations until the last possible moment is the ultimate purpose of human existence. They had fulfilled that role to the very best of their ability, although it had often been very difficult and there were times that it looked like they might not pull through. But they had, and everyone existed in a state of great anticipation for the moment of culmination of their purpose, which was to continuously make observations until the universe was safely escorted into the arms of the singularity.

The Observers were highly motivated and prepared themselves in every conceivable way. They constructed countless observation platforms that were awesome and magnificent, of every conceivable material and of every conceivable design. Some held thousands of Observers, some with hundreds, some with dozens, and some with only one. Although they had accumulated the knowledge of the ages and the wisdom that came with it, they had enormous respect for the unpredictable, and even though practically everything that could happen in the universe

had happened, what was yet to come had that eternal element of uncertainty. Their vital task was to reduce that uncertainty as much as possible. Although they knew that they could not observe the final instant of the universe, just as they had not been able to observe the initial instant of the universe, they knew that by making observations ever closer to that final instant they would learn more and more about it until its nature would be known with high certainty. The great questions to which they had no definite answers were: How close to the end did they have to make observations in order to be close enough, and could they maintain their vigil long enough to reach that point? The great philosophers had debated these questions through the ages. At the end of all that, the only thing they knew for certain was that their innate qualities were such that the probability of success was very high; otherwise their universe would not have gotten this far. But they also knew that bundled into that probability was the tumultuous nature of the Observer spirit, which included the uncanny ability of an individual to do something at the absolutely crucial moment that could make the difference between success and failure. For all they knew, the fate of the count-less ages of the universe, and thus the countless lives of the countless Observers, would all come down to a split-second action performed by a single individual. Perhaps this action would be performed as the very last action by the very last Observer to perish in the enormous heat and pressure created during the approach to the cataclysmic singularity.

It would be at that moment that the very last observation that can be made in the universe is made. At that moment, all that can be known about the universe is known. All the material substance of the universe, all its energy, and all its accumulation of Souls would merge into

a single undifferentiated state to become one with each other as well as all other elements of the universe. A total Oneness of everything; all knowledge, all feeling, all experience, all substance. The instant of this Oneness would coincide with the achievement of the singularity, whereupon the purpose of our existence would be realized. If that happens, we will have done our job and done it well.

Beyond the wall of the singularity.

We can proceed beyond the singularity only in our imagination, for it is a wall beyond which we can never go. Although it is forbidden to us, perhaps there is a there, there. Perhaps if we could somehow be on the other side of the wall at the instant of the singularity, we would see an incredible flash of light that is at first formless; but quickly begins to acquire a shape. Within a few moments it begins to look more and more like a Being of some kind. It is shaped like a human, but much more glorious than any human we have ever seen. It is stunningly beautiful. We begin to realize what it is. It is a totally merged composite of everything that the universe from which it was formed contained. It is beautiful to us because it is a composite of every person and every consciousness. just as the superimposing of photographs of people from all around the world creates a composite image of a face that strikes us as more beautiful than the individual faces, this composite Being, who is a composite of everyone who ever lived, is the most beautiful Being possible. It is dazzling white, because its color is a composite of all colors. Its gender and age are indefinite, because it is a composite of all the men and women who had ever lived; all the young, and all the old. If we were to look at its face, we would see there the traces of

everyone we had ever known, everyone we had ever loved. Written across this face would be all the experiences of all the people from which it was made. All the joy, all the sadness, all the pleasure, all the pain that had ever been experienced would be there. All the wisdom of all the ages would be there. Within the experience of this Being would be everything that had ever happened in the universe. It would have the knowledge of the birth of every star, the death of every planet, the birth of every child, the death of every person, the laugh of every baby, the tears of every woman, the fears of every man. It would know of every sunrise and every sunset. Every hope, every dream. Every success, every failure. It would know everything. To look at this face is to look at the face of God.

Perhaps this awesome Being were to approach the wall of the singularity. It might see there, suspended and waiting quietly, two universes side by side. One is a universe at the moment of its beginning, the other a universe at the moment of its end. They are clearly a pair, and the one is related to the other. The Being approaches the two universes. (S)he knows what to do, having done it countless times before. (S)he embraces the two universes, bringing them closer and closer together. As they get closer, the Being begins to change form, and to flow toward the two universes. All three get closer and closer, and it becomes clear that they are going to merge into one. The universes fill with the essence of the Being as they approach Oneness. They get closer and closer to the cataclysmic and singular moment. It arrives, and everything that was possessed by the essence of the Being becomes One with the new universe, which is now simultaneously at its beginning and at its end.

Whereupon an infinitesimal point appears on the other side of the wall, which inflates and begins to expand

with incredible speed. It is accompanied by a great light. A new universe is born. It seems to be nothing but energy that is in the process of coalescing into matter, but it is clearly much more than this.

Part II

The Physics of Observation

A Philosophy Is Not Enough

It is good to have a philosophy because it provides a foundation upon which our lives and behavior can be built. A good philosophy can provide us with a sense of purpose and a moral compass that allows us to choose right from wrong. But in order for a philosophy to be truly powerful, it must have more than a logical argument. This is because every logical argument begins with axioms and no matter how carefully selected, these axioms may be wrong. Moreover, no matter how logically you attempt to proceed in development of the philosophy, you may make an error and take a wrong turn. Making the logical development a group effort guards against this, because where one person fails to see a logical flaw, another may succeed. But even a group can go wrong, so that is not a solution. The philosophy presented in Part I may please some, and displease others. Those who find it appealing will be inclined to accept the axiom "that which cannot be observed does not exist;" and not find fault with the logic of the subsequent development. Such individuals might have sufficient confidence in the resulting philosophy to use it to help them guide how they live their lives and make moral judgments.

However, I would not be surprised if someone were to reject the basic axiom "that which cannot be observed does not exist," and accordingly feel free to reject the whole philosophy, including its moral guidance. This is the same process by which a person chooses a religion, because every religion has certain axioms that once accepted become the

basis of accepting the whole. To be Christian requires belief that Jesus is the Son of God. To be Muslim requires belief that the only God is Allah, and Mohammed is his prophet. Unless these axioms are accepted, the respective religions cannot be accepted. Similarly, without accepting its basic axiom, the Philosophy of Observation cannot be accepted. The possibility that its fundamental axiom may be wrong puts the entire philosophy on a shaky foundation. Because of this shakiness, the Philosophy of Observation is no better than any other philosophy or any religion.

The only way out of this dilemma is to test this philosophy against the physical laws of the universe. The universe behaves in many strange ways, and we have already seen how "that which cannot be observed does not exist" is consistent with many of these strange ways. But for the axiom to be actually true, it will have to be consistent with every law and phenomenon in the universe that we know about, and even with those that we do not yet know about. This is a very tall order, but unless it can be demonstrated to be true, there is no reason that the Philosophy of Observation should be accepted as a source of spiritual guidance.

Physicists have had considerable success in explaining how the universe works and defining its laws. However, there are some things that they have not been able to explain, such as gravity. Nor can they explain the basis of inertia and momentum. Biologists have had considerable success in explaining the nature of life. However, there are some things that they have not been able to fully explain, such as how life began, or how the brain works in its ability to form and recall memories, or to think and reason. We do not understand the nature of consciousness, nor the sense we have of self, often termed the Soul. For the Philosophy of Observation to be worth anything, it would

have to encompass all these things, and everything else as well.

I think it can, but to do so, one must abandon conventional thinking and develop a new outlook on the laws that govern the physical universe, and how it works. It is easy to say this, but if one abandons conventional thinking, thinking that is established on a foundation thousands of years old, then one needs guidance as to what new kind of thinking to adopt. We need a compass in order to find our way, just as the pilgrim needs a compass in order to find his way through unfamiliar land to his holy destination. As he comes to forks in the road, he has to decide which direction to choose. He takes a compass out of his pocket. It points in a consistent Direction. It is his Guide. With it, he avoids seductive wrong turns and continues toward his destination. Even when he finds himself on a deserted road or untrodden path, he can proceed in confidence because he has his compass.

My compass is "that which cannot be observed does not exist." The compass points to the idea that the making of observations is essential to the existence of the universe. We therefore need to follow along a path, but not just any conventional path. It is a path that must go in a circle, and each point of the circle must relate to its center, which is the making of observations. In order to understand phenomena such as gravity, inertia, momentum, memory, intelligence, and the immortal Soul, it is necessary to relate these things in a very direct way to the making of observations, and that the making of observations is what creates the Reality of the universe. It is only this Center that we need concern ourselves with, and nothing else. Our task is therefore to interpret the Laws of the Universe in terms of this Center, and their relation to this Center. As we do this, we will discover that the na-

ture of the universe is something quite different from what we thought it to be.

The Crucial Role of Observations

One of the first tasks is to explain how it is possible that Observers are so important to the universe that it cannot come into existence without them, nor can it persist in its material existence without them, but that it would somehow become fuzzy and to fade away if there were no Observers. Perhaps a part of the answer is in the nature of fundamental particles and their relationship to Time. Time is a continuum, in which everything we experience is at the Present Moment. Everything prior to the Present Moment is the Past, and everything that follows the Present Moment is the Future.

Imagine a single elementary particle, such as a proton. This particle exists along a time continuum; from the Past, through the Present Moment, and into the Future. Of all of the time of eternity, the only time that we can observe the proton is at the Present Moment, and it is just a little bit fuzzy because of the unresolvable uncertainty imposed by the Uncertainty Principle. This uncertainty imposes a mild unreality on the universe; but over the short term, this unreality is not sufficient to cause the universe to become unreal and thus nonexistent. But the universe exists over the long term and has to continue going for a long time. Perhaps the uncertainty imposed by the Uncertainty Principle can build up over time, causing the universe to become so ill-defined that it can no longer exist as a real entity. Cosmology holds that the universe began at a singular instant, which could serve as an instant of synchronization, and all of the elementary particles of the universe

have been ticking like a multitude of clocks ever since. Each one of these particle clocks is moving along a time line that has a Past, Present Moment, and Future. Unless all of the elementary particles are moving along their respective time lines at the same rate, the Present Moment will become increasingly fuzzy and ill-defined for the entire collection of elementary particles.

To illustrate the problem, suppose you had a billion highly accurate clocks, and you started them all ticking at the same instant. No matter how accurate these clocks are, the Uncertainty Principle assures us that they will become unsynchronized over time. If these are the only clocks you have, you cease to know exactly what time it is. This might not matter at first, because the clocks agree closely enough for you to get by. But eventually, *you* will begin to miss important appointments because you are using one clock and your doctor another. Your solution is not to make better clocks, because that is impossible. The solution is to figure out a way to re-synchronize the clocks you have. It is really the agreement of the clocks that is important, not that they are all telling the correct time, which doesn't really mean anything anyway. For this synchronization to happen, the universe needs to possess physical laws that enforce re-synchronization. If no re-synchronization system appears, then eventually the universe will cease to exist. If a re-synchronization system appears, persists for a while, and then disappears, then it is only a matter of time before the universe will fade into a state of unreality. Perhaps Observers are the re-synchronization system. If they are, it is of vital importance to the universe that we perform our observations and continue to do so until the universe ends. Otherwise, the universe will become increasingly uncertain and fuzzy, and eventually fade into oblivion.

The Philosophy of Observation Implies a Mechanism That Links Observations to the Material Existence of Objects

All objects are waveforms.

What this does not tell us is the mechanism by which the re-synchronization might occur, nor the process by which mere observations can make a crucial impact on the existence of material objects. Our intuition tells us that the objects that surround us are simply there, and the fact that we look at them, or touch them, or smell them, or listen to them, or taste them, seems rather incidental to their existence. In order for observations of objects to have relevance to their existence, there must be some mechanism by which the observation of an object has an impact on its material existence. The Philosophy of Observation suggests that there is such a mechanism, and to develop an understanding of it, I will turn to one of the central ideas of Quantum Mechanics, which is that all elementary particles possess characteristics of waves, and hence, all material objects are waveforms. I will now develop the idea that when an Observer makes an observation of the waveform of a material object, something happens in which the observation results in an enhancement of the Reality of the object's waveform. I will not assume that the Observer must be human or even alive. However, as the development of the idea progresses, you will see that the kinds of observations that a human Observer can make are more powerful in enhancing the Reality of material objects than are the observations that are made by nonliving things, or even primitive living things.

Everything is observations and waveforms.

In order to pursue an understanding of this mechanism, we need to convert "that which cannot be observed does not exist" into a new form. Recall that this axiom was originally developed as an embodiment of the philosophical questions that are raised by the tree falling in the forest. To proceed further, we now need to convert this axiom into something that retains its essence, but from a new perspective. This new perspective recasts "that which cannot be observed does not exist" into *'everything in the universe exists as waveforms and the observations that are made of these waveforms.'* This new statement retains the idea that something cannot exist unless it is observed, because it asserts that material objects and the observations that are made of them are intertwined. Accordingly, if an observation of something cannot be made, then it cannot exist. Everything that follows has resulted from an attempt to interpret the entire nature of the universe from this perspective. It is analogous to building a house out of paper clips. We ordinarily build a house out of normal building materials such as bricks and mortar and slabs of wood. When we allow the use of conventional materials, we can proceed to build using conventional methods. But if we limit ourselves to building with paper clips, we need to invent new concepts of building. If you want to build a doorway out of paper clips, you need to think more deeply about the nature of a doorway, and the approaches to its design. You would need to establish a new perspective toward compressive and tensile forces, and how to deal with them, and how to attach the paper clips together in ingenious ways. It is quite likely that the fact that you have limited yourself to building with paper clips will cause you to discover some pro-

found new insights about design and construction. Some of these insights might be truly amazing and would never have been thought of unless you had arbitrarily decided to limit yourself to the use of such a simple material as paper clips. So it is when we limit ourselves to the use of nothing but observations and waveforms to understand the mysteries of the universe. We will need to begin by thinking about waves, and that all of the fundamental particles like quarks, photons, electrons, protons, and neutrons are all waves; and since all physical objects are composed of these particles, all physical objects are waveforms.

You can open any basic chemistry textbook and find a presentation of the concept that atoms and molecules consist of waves, and how chemical reactions consist of interconversions among atomic and molecular waveforms, called orbitals. One of the simplest of these waveforms is the hydrogen atom, which consists of a proton nucleus and an electron. The composite waveforms of the other elements are more complex as a consequence of adding neutrons and additional protons and electrons. We, ourselves, are merely very complex waveforms. It would seem that in order for us to understand ourselves in a fundamental way, we need to know about waves.

Some Basic Concepts of Waves and Resonance

We encounter waves all the time, and scientists have studied them extensively. A familiar type of wave is a sound wave, such as what we hear when we press a piano key, pluck a guitar string, or strike a tuning fork. The string or tuning fork vibrates in response to being struck, and these vibrations are propagated through space as a wave,

which possesses a particular loudness (amplitude) and pitch (frequency). Some important properties of waves can be demonstrated with tuning forks. If you hold a tuning fork by its handle and strike one of its tines, a clear tone will be produced. The loudness of the tone will be determined by how hard you strike the fork. The pitch of the tone is determined by the properties of the tuning fork, such as the length and thickness of the tines and the material of which they are made. If you touch the handle of the vibrating tuning fork to the body of a guitar, the guitar will produce a sound that is much louder and more complex than the sound of the tuning fork. The guitar makes a sound because it resonates with the vibrations of the tuning fork. This resonant sound is more complex than the one produced by the tuning fork because the guitar is designed so that it emits waves that are harmonics, or multiples, of the fundamental frequency of the tuning fork with which it is resonating.

Now lay the guitar flat, and glue the handle of the tuning fork to the top of the guitar, so that the tuning fork is sticking straight up into the air. The guitar is now a resonant pedestal for the tuning fork. If you strike the tuning fork, its vibrations will cause the guitar to resonate, and you will hear the sound clearly throughout the room. Now suppose that you construct an identical guitar with tuning fork attached, and place it near the first guitar. If you strike the tuning fork attached to the first guitar so that the guitar vibrates and gives off a tone, you will discover that it is not long before the second guitar begins to vibrate in exactly the same way. This is also the result of resonance, sometimes called sympathetic vibration. In order for this sympathetic resonance to occur, it is essential that the tuning forks attached to the guitars vibrate at the same frequency. If one of them vibrates at a frequency corresponding to the

musical note A, and the other vibrates at frequency corresponding to the musical note B, this sympathetic resonance would not occur. Only if both are A tuning forks, or if both are B tuning forks, will this sympathetic resonance occur.

The lesson of observing the tuning fork with a violin string.

Let us now consider another idea involving the use of a violin as a wave source. Suppose you stand in front of an A tuning fork that is fastened to a resonant pedestal, and play the A string of the violin with a bow. Since the natural vibration frequency of the fork is A, it is very sensitive to vibrations at this frequency, and it begins to resonate with the violin string. This is a mutually reinforcing process, with the initial wave from the string causing the tuning fork to resonate in sympathy, which in turn produces a wave that causes the string to resonate in sympathy, which in turn produces a wave that causes the fork to vibrate in sympathy, and so on back and forth.

Once this resonant system has become established, it becomes confusing as to whether it is the violin string or the tuning fork that is responsible for maintaining the resonant system. There is a crucial difference between them, which is that the violin string is the only one with a source of energy, which is delivered to the string from your muscles via the bow. If you stop bowing, it will not be long before the sound from the resonant system will die away, and the tuning fork will stop vibrating.

Now let's develop this idea by assuming that we have two identical rooms, except that one room has a tuning fork on a resonant pedestal, and the other does not. You are blindfolded and escorted into one of the rooms.

You are told that you cannot move around the room, and that you are to determine if there is an "A" tuning fork in the room. Fortunately, you have your violin with you, which makes this a very simple task. All you have to do is bow the A string, and if you hear nothing other than the violin string you are bowing, you know you are in the room without the tuning fork. However, if you are in the room with the tuning fork, it will begin to resonate so you can hear it. You know the tuning fork is there because *you* have observed it by means of the waveform from the violin string. Because the string is the source of energy, it becomes the "Observer," and because the tuning fork vibrates solely by means of resonating with the energy input from the Observer violin string, the sympathetically vibrating tuning fork is the "observed." Without the energy that is provided to the "Observer" string, there would be no way to observe the tuning fork. If you had absolutely no other way than this to determine the existence of the tuning fork, then without the violin string and its energy input, whether you are in the room with the tuning fork, or in the other room without the tuning fork, would be unknowable to you.

Waves can combine to reinforce each other and can also cancel to become nothing.

Waves have a peculiar property that is so strange and mysterious that it borders on the metaphysical. It is a property that physicists have studied thoroughly, so it is very well understood. This peculiar property of waves is that when they merge, they completely lose their identity as separate waves, but instead combine into a single new composite wave that is a summation of the separate waves. This

summation may result in the composite wave being larger than the separate waves, or smaller, depending on whether they "constructively interfere" or "destructively interfere." Constructive interference occurs when the waves are in phase, and destructive interference occurs when the waves are out of phase. If two identical waves are perfectly in phase, the composite waveform will have twice the amplitude of the separate waveforms. Conversely, if they are perfectly out of phase, they will cancel each other completely. If you are in a room that is being irradiated by two waves that are identical except that they are precisely out of phase, it will be completely silent. It is important to note that the two individual waves are not just covered up or masked, like a perfumed spray masks bad odors, but that they have ceased to exist.

This situation does raise a philosophical question, which results from the fact that a room with destructively interfering waves is not identical to a room with no waves at all. Suppose the room contains two speakers in which one produces a wave that is out of phase with the other. When both speakers are operating, the room is silent. However, if you turn off one of the speakers, the room is suddenly filled with the sound from the other speaker. This is clearly different from a room with no speakers, but if there is no way to turn off one of them it would be difficult to tell the difference.

Let's extend this idea by imagining a room that contains several speakers, each one producing a sound of random frequency and amplitude. If you stepped into a room with a half-dozen of these speakers, you would be confronted by a raucous noise. Now start adding additional speakers to the room. At first, the sound in the room would increase as you added speakers. But oddly enough, as you got to where you had placed a large number of speakers in

the room, the intensity of the sound would begin to decrease. This is because of destructive interference. Since each speaker is emitting at one at a random frequency, when you have many such speakers, it becomes likely that there will be some that produce tones that destructively interfere with other tones. If you continued adding speakers until there were millions of them (let's say they are really small), the room would become progressively less noisy until it would become nearly silent. How many speakers it would take to do this is difficult to say, but this would be the trend.

If a physicist were sent into this nearly silent room with instruments that can measure the intensity of sound, he would detect very little, despite the fact that the multitude of speakers are flooding the room with sound waves. But suppose as the physicist is taking measurements, some-one else comes into the room and says something to him. The physicist would look up at the newcomer and see his mouth appear to be making words. But he would hear little sound coming out, because the myriad random frequencies from the speakers are capable of canceling out all kinds of sounds, including the voice.

The physicist might then realize that while he had been working in the room, everything had been nearly silent. He had not noticed the scuffling of his own shoes, or his own heartbeat, or clicks from the switches on his equipment when he turned them on and off. The physicist might put two and two together and realize that he was in a room that was nearly silent because it was filled with destructively interfering sound waves. The fact that the room was silent and canceled out all kinds of sounds including voices, scuffling feet, and switch clicks, would tell him that there was an enormous number of such waves in the room. He might try to estimate how much sound energy was present in the room by determining how loud he had to shout

in order to be heard. If people were to live in this room and had never experienced any other place, they would assume that having to shout in order to be heard is perfectly normal. As far as they were concerned, the sound of their shouts would be the only sounds that existed. The fact that they were actually immersed in a sea of mutually-destructive sound waves would be completely unknown to them.

The universe is thought to be "created out of the vacuum of nothing."

One of the most widely accepted theories of the origin of the universe proposes that it was created out of nothing, and is the ultimate "free lunch." One way of accounting for this is that a vacuum is not truly empty but is instead filled with an enormous amount of energy. This energy is in the form of waves, and just as the random tones in the room with millions of speakers become nothing by undergoing destructive interference, the energy of the vacuum sums to zero. This summing to zero is what happens almost all of the time. But since the energy is present as a random collection of waves, there is a non-zero probability that in some place at some time, they might not cancel out completely. If this were to happen at all, the disparity from zero could be extremely large; even large enough to provide the huge amount of energy required to start our universe. This random disparity apparently occurred within an extremely small volume of space, which then underwent a process of inflation, whereupon some of the energy coalesced into matter; which was shortly followed by an enormous explosion ("Big Bang"), with the universe a result of expansion that has been occurring ever since.

The idea that a vacuum is not truly empty-but actu-

ally filled with an enormous amount of energy whose random fluctuations sum to zero-is well-established. Earlier, the idea that matter consists of waves was explored. Inasmuch as energy waveforms and matter waveforms are interconvertible by Einstein's relation between matter and energy ($E=mc^2$), it does not seem too much of a stretch to assert that a vacuum contains not only energy waveforms that sum to zero, but also matter waveforms that sum to zero. If this is so, then a cubic meter of what appears to be an empty vacuum might contain a waveform corresponding to any conceivable material object that could fit into this cubic meter. But since all of these waveforms are undergoing destructive interference (because they are a random collection of waves), the vacuum appears to contain nothing at all.

The lesson of the computer monitor and the copy machine.

Whereas it may seem strange that a multitude of waveforms are present in a vacuum, we encounter this idea all the time when we use computers and copy machines. Suppose you are sitting in front of a color computer screen that is on, but blank. It is completely white. The reason it looks white is that each pixel of the computer screen contains a red, green, and blue dot (an RGB screen) and all three dots of every pixel are lit. When our brain receives a signal that consists of a mixture composed of equal intensities of R, G, and B, it interprets it as white.

In order to implement the ability to draw on the screen, the computer programmer has written a program that turns off pixel elements. Accordingly, if you draw a red line on the screen, what the program does is to turn off the G and B elements in appropriate pixels, so that the R ele-

ments become visible. Note that the R elements were lit all the time, but you just didn't see them because of the fact that the G and B elements were also lit. Suppose you are an artistic person, and you decide to render a picture of the Mona Lisa on your screen. Although the program would take care of the nitty-gritty details, what would actually happen as a result of your drawing is that certain R, G, and B elements throughout the computer screen would be turned off. Nothing at all would be turned on.

Now that you have completed your drawing of the Mona Lisa, you lean back to look at it and admire it. You honestly feel that you created it from nothing. But really, there is absolutely nothing on the screen that was not there before. Not a single pixel or R, G, B element is visible that was not visible before. In a sense, when you are looking at a blank screen, you are looking at every image that it is possible to draw on the screen. Because they are all there, you perceive none of them, and the screen appears empty.

Now let's think about this idea from a different perspective, using a piece of paper and a copy machine. A copy machine is capable of placing tiny black dots anywhere on a piece of paper. If no dots are placed anywhere at all, the paper is white. If a dot is placed at every possible location, the page is completely black. If the dots are placed at strategic locations, images appear. Depending on their placement, it is possible to create any conceivable image. One such image might be the Mona Lisa. Or a naked lady. Or the Constitution of the United States. The likelihood of your coming up with any of these particular images by placing random dots on a piece of paper is very small; just as it is very unlikely that monkeys banging away at typewriters would eventually write *Hamlet*. However, suppose that you, as an accomplished artist, sit down with a blank piece of paper and a pencil and spend an entire week drawing an

exquisite rendition of the Mona Lisa. If you looked at this drawing from a proper viewing distance, you would see the Mona Lisa. However, if you put the paper under a microscope, you would see that it really consisted of microscopic particles of graphite placed at strategic places around the paper.

Having completed this task, you want to make copies. What do you do? Do you sit down with a new blank piece of paper and a pencil and start all over? No. You walk over to the copy machine and place your drawing of the Mona Lisa face down on the glass surface and punch a button. After a few moments, out of the machine comes a faithful copy. If you were to look at it under the microscope, you would find that the image is now constructed of tiny particles of toner, all placed at strategic locations around the paper.

The end results of the processes of making the original drawing and making a copy are basically the same, which is to put strategically placed dots on a piece of paper, and the original drawing and its copy look very similar. Since the end result is the same, why is it that the two processes took such dramatically different amounts of time? The first image took a week to produce. The second image only a few seconds. We instinctively understand that the first image required the input of artistic creativity, whereas the second image was only a copy that was created by a rote process. A major difference is that it is vastly easier to make a copy of something than it is to create an original. In fact, if you look around, it is very difficult to find something that is complex that is not a copy of something else. This is certainly true of biological things, which are always copies of previously existing biological things. Anything that is the way it is without being a copy of something else is usually pretty ordinary. Like a rock.

Moving objects on a computer screen is an erasing-and-redrawing process.

Now let's go back to where you drew the Mona Lisa on your computer screen, and consider how you went about doing it. When you want to draw a line, you can use a mouse to generate a line that mimics the motions of the mouse. Although this is not nearly as satisfactory as actually grabbing a pencil and drawing lines, as time passes, you become more and more adept with the mouse, and you feel more and more that you are actually drawing the lines on the computer screen. Of course, what is actually happening is that the computer program is sensing the motions of the mouse and using this information input to turn off appropriate pixels on the screen. You understand computers well enough to know how this is actually happening, but as you get engrossed in drawing the Mona Lisa's hand, you tend to forget about it and concentrate on the link that is between the picture of the Mona Lisa's hand in your mind, and the picture of the hand that is appearing on the computer screen. What you are trying to do is get what you see on the screen to conform to what you see in your mind, and the movements of the mouse are merely the means to that end. If you were to work with this drawing program for a long time, the link through the mouse would fade from your awareness, and you would simply draw with the mouse with the same unconscious ease as you used to do with a pencil.

After a great deal of time and effort, you finish the Mona Lisa's hand and you are really proud of it. Suddenly you realize you have done a really stupid thing. You drew the hand right in the middle of the screen, instead of where it will have to be within the context of the final picture, which is down and to the left. Do you even for a moment

consider that you will have to erase this drawing and start all over in the correct location? No. You use the mouse to "drag" the hand across the screen. When you finish dragging, the drawing of the hand, which appears completely unaltered, has moved to a new location.

Watching the movement of the Mona Lisa's hand through the eyes of a child.

What if a child were beside you observing what you are doing? When the child sees the hand move from one location on the screen to the other, she would reasonably assume that what had actually happened was what she saw happen, which was that you somehow grabbed hold of the hand with the mouse and moved it to a new location. If she were to ask you how you did this, you would probably just demonstrate how to do it, accompanied by the following explanation. "Just grab hold of the hand by pressing and holding down the mouse button. Now move the hand from one place to the other by moving the mouse. When you have gotten the hand to the location you want, let go of it by releasing the mouse button."

The child might spend an entire morning moving things around the computer screen this way. What would she think about the process by which the hand moves? Would it occur to her that what is really happening is that when the hand moves, its image is being erased from its original location and redrawn at the new location? Or that the appearance of movement across the screen is not movement at all, but the result of very fast computer calculations that can very rapidly draw the hand at one location, quickly erase it, redraw it again in a slightly different location, and repeat this process again and again until the image comes

to rest at its final location? If she were to examine the image of the hand at its final location very closely, it would be absolutely identical to the image of the hand in its original location. She would therefore have no reason to suspect that it was not actually the exact same hand that has merely been moved from one place to another. She would probably feel about the hand on the screen in exactly the same way that she feels about her very own hand as it is resting on the mousepad. When she moves her own hand from one location to another, she sees the same kinds of events as when she moves the image of a hand on the computer screen in that it starts out in an initial location, then moves through a series of intermediate locations until it gets to where it is going. She doesn't even bother to inspect her own hand at the end of its motion to see if it is the same hand as the one at its original location. It is so obvious that it is the same hand, that it wouldn't occur to her it could be otherwise. Neither would it occur to her to think the hand at its initial position on the computer screen is any different from the hand at its final position on the computer screen. Nor would she see any difference between the motion of the hand on the computer screen and the motion of her own hand. You would think she is pretty stupid to believe that there is no difference, because you know that the hand on the computer screen moves by a process that involves erasing the image from one location and redrawing it at another. Unlike her own hand, which is actually moving.

But perhaps it is you who are stupid, and that the two processes are very similar, and the girl moves her own hand by a process that is very much like the erasing-and-redrawing process that moves the hand on the computer screen. I would like to pursue this idea further, but it is not possible without developing some other ideas first. But remember this concept of the movement of objects as being

an erasing-and-redrawing process, because I will be making important use of it later.

The Making of Observations by Heavenly Bodies, Grains of Sand, and Neurons

You may think it odd that despite the fact that Philosophy of Observation is centered on the importance of Observers, the nature of "what is an observation" has not yet been addressed. I will do this now. As human beings, we associate "Observations" with what we do when we detect things with one or more of our five senses, particularly when we use our eyes to look at something. Whereas I am trying to argue that our ability to make observations is crucial to the existence of material objects, it does seem a bit ludicrous that the entire universe would immediately cease to exist if we all shut down our senses. If this were to happen, I am inclined to think that the universe would continue on without our participation for a considerable time, but would only perish in the long run.

One reason that the universe could persist for some time in the absence of living Observers is because non-living objects are capable of making observations, so the universe is making myriad observations of itself all the time. However, I will argue that the observations made by ordinary objects such as planets and rocks are fuzzy and indistinct compared to observations performed by living things, especially complex living things such as human beings. These indistinct observations may be good enough to keep things going for a while, but perhaps are not good enough for the long haul. Another reason that the universe may be unable to persist without living Observers is that it does not have the ability to exercise Free Will. When human

Observers observe something that does not please them, they have the ability to do something about it such as cut down an offending tree, or build a monument to the sun-rise in a deserted and desolate place. Without Observers that can exercise Free Will, the universe has only one possible future, which is dictated by the laws of physical mechanics. The slightest exercise of Free Will by a living Observer has the effect of deflecting the universe from this predetermined Destiny. If you kick a rock out of your path, the universe changes out of this predetermined Destiny to another Destiny, and this new Destiny will be forever different from the one that would have been if you had not kicked the rock. Although your kicking of a single rock is a small effect, the cumulative effects of the actions of myriad Observers could have a profound effect on the Destiny of the universe. Perhaps the Destiny of the universe in the absence of living Observers is not one that is conducive to persistence of existence, and without being re-directed by Free Will, the universe may be doomed.

"What is an Observation?"

We are so used to the idea that making observations is something that humans do, that it is difficult to consider simpler kinds of observations. I will argue that observations can vary enormously, ranging from very simple to very complex. I will define an "observation" as any situation in which one physical entity impinges on another physical entity in such a way that the first entity affects the second entity in some way. That is, in the presence of the first entity, the second entity is in some way different than it would be in the absence of the first entity. This definition is very broad and states that because of gravity and the exchange of electromagnetic radiation among the heavenly

bodies, that they are "observing" each other all the time.

Consider that the universe started as a Big Bang, and all its parts have been flying outward ever since. The volume of space they now occupy is quite large, but matter is not evenly distributed within this volume of space. Matter is instead organized into galaxies, star clusters, and solar systems. Within solar systems, there are planets, asteroids and comets orbiting suns, and moons orbiting planets. Each of these objects is behaving in response to the presence of all the other objects. Instead of flying away in a straight line, our moon is in a circular orbit around the earth. The earth and moon are in a mutual embrace, each affecting the other through gravitation and exchange of electromagnetic radiation. Without the earth, the moon would behave differently than it does. Without the moon, the earth would behave differently than it does. These mutual interactions, which cause the earth to behave differently because of the moon, and cause the moon to behave differently because of the earth, constitute "Observations" between the earth and the moon. An attribute of these particular observations is that they are indistinct and of poor resolution, because the earth and moon consist of just two bodies, and they are separated by a considerable distance. Observations that are more distinct and more highly resolved require the participation of objects that are greater in number and closer together.

The observations that the earth and moon make of each other are accordingly among the simplest kinds of observations, because there are only two objects participating in the observation, and these objects are far apart. A more complex observation is the entire solar system observing itself, because it consists of many objects, although they are still far apart. If we include all the planets, moons, comets, and asteroids in the solar system, there

are millions of objects that are observing each other.

Consider that these mutual observations among the objects in the solar system constitute a kind of "knowing" or "awareness" in the sense that the moon is "aware" of the earth and where it is, by the direction of its gravitational pull and electro-magnetic radiation that it receives from the earth. However, although this information "tells" the moon the direction that the earth is in, it does not receive enough information to determine exactly how far away it is. This illustrates how just two objects orbiting each other have limited "knowing" in that each can accurately judge the direction of the other, but not its distance. However, if you add a third object to the system, you can now employ the principle of triangulation. If there are two moons orbiting the earth, each of the (now three) objects can more accurately determine the direction to the other two, and they can share information among themselves to determine the distances among them. This is because the three interacting objects cause mutual perturbations in their orbits that provide this distance information.

The idea here is that as you increase the number of mutually interacting objects in a system, the amount of information that is available about the location of any one of them is increased. Our earth is therefore "feeling" the presence of all the other objects in the solar system, and each one exerts an effect on the orbit of the earth. This provides an enormous amount of triangulation information that "informs" the earth about both the direction and distance of each of the other objects. If astronomers had telescopes that were capable of observing the orbits of all these millions of objects, they would be able to calculate their relative positions fairly precisely. The more objects there are, the more precise the calculation would become. The information is there whether you do the calculations or not. In a

sense, the solar system is doing all of these calculations all of the time in that every object in the solar system constantly follows an orbital path that is affected by every other object in the solar system. The solar system is accordingly highly triangulated, and the more objects a system possesses, the greater the degree of triangulation becomes.

One could say that a solar system with many objects in it is a "better-defined" solar system than a solar system with fewer objects. Or one could say that that a solar system with many objects is doing a better job of "observing itself" than is a solar system with few objects. If "that which cannot be observed does not exist" is correct, it implies that the solar system with many objects somehow has a "stronger existence" than a solar system with fewer objects. Perhaps you could substitute "more real" for "stronger existence." Or you could say that a solar system with many objects in it possesses a "more intense Reality" than a solar system with fewer objects. The idea is general in that it does not apply merely to heavenly bodies, but to any group of objects. Consider grains of sand lying on a beach. Each of the millions and millions of grains is exerting its effect on every other grain. If you moved one grain of sand from one position to another, the effects it would exert on the other grains would change. All the sand grains are "observing" each other in much the way that the planets observe each other in orbit. Except for one thing. The planets are moving relative to one another, and the grains of sand are not.

Biological Neurons Are Designed in a Way That Allows Them to Impose an Intense Reality on Themselves and Their Surroundings.

If "that which cannot be observed does not exist" is

correct, then a fundamental proposition implied by it is that the *observation of an object confirms its existence, and the more observations you make, the more confirmed this existence becomes.* This establishes the principle that *increasing the number of objects in a system causes an "intensification of the Reality" of the system.* When you have just two interacting objects, the intensity of Reality is low. When you have a solar system with millions of objects, the intensity of Reality is much higher. One could say that the objects in the solar system are more real as a result of their having gathered together.

Let us now consider how Reality could be intensified as much as possible. To do this, we need to think not only about the number of interacting objects that there are, but their size, and their distance apart. This is because of the bizarre nature of Quantum Mechanics, which dictates that the rules that operate on objects that are very tiny and close together, such as atoms and subatomic particles, are different from large objects such as pencils, people, and planets. It is also because of the Uncertainty Principle, which tells us that the precise location and momentum of an object, especially very tiny objects, cannot be determined simultaneously.

The argument is that if an object is subjected to few observations, its intensity of Reality is low. If you increase the number of observations you make of it, its intensity of Reality increases. The more observations you make, the more intense the Reality becomes. One can imagine that there is some critical threshold of Reality that you must cross in order for waveforms to collapse into real, definable objects whose physical properties (velocity, mass, location) are sufficiently well-defined that they can exist. The universe as we know it has clearly passed this threshold. But could this threshold have been passed solely as a consequence of the intensity of Reality that is imposed by the

heavenly bodies in their orbits? Or the grains of sand on the beaches of the planets? Perhaps this is not enough to pass this threshold. Perhaps there needs to be a system that possesses vastly more objects than the solar system in order to pass this threshold. And perhaps this system needs to have objects that are much closer together and much smaller in order to provide the triangulated information necessary to pass this threshold.

Living cells have huge numbers of molecules that interact in an organized manner.

It is not among the heavenly bodies, but in the biological world that we need to look in order to find such highly triangulated systems of objects. Living organisms are composed of myriad tiny objects (atoms and molecules) that are in a highly organized state. A single human cell, with a volume of about a picoliter, contains about ten trillion molecules, most of which are water molecules. There are also hundreds of millions of protein molecules, as well as fat molecules, carbohydrate molecules, and nucleic acid molecules. Also a billion molecules of the metabolites that are the products of the tens of thousands of distinct kinds of enzymatic reactions in the cell. There are also hundreds of millions of atoms of many kinds of metals, such as sodium, potassium, and magnesium present all within this single cell. An attribute of almost all of these molecules is that they have ionic charges, such as the proteins and the metal ions. Or they are polar, such as the water molecules. These charges interact, like heavenly bodies, to form a highly triangulated system that informs each of the charged species about the direction and distance of each of the other charged species. A cell, with all of these objects in a highly

interactive state, provides a much higher level of "knowing" than does the solar system. It is particularly important to realize that any one of these tiny objects, if placed in an isolated spot, would be in a highly undefined state as dictated by the Uncertainty Principle. But surround this tiny object with many other tiny objects that are very close together, and allow them to interact through electromagnetic forces, and the principle of triangulation reduces the uncertainty of the position of any of the objects at a particular time to a very low level. Because the cell is composed entirely of very tiny particles that are very close together, and because they are in a highly interactive state, and thus are highly triangulated; the cell should possess a highly intense Reality.

**The neuron specializes in the intensification of Reality.
The lesson of the dancers connected by strings.**

Whereas what has just been said is true of all cells, it applies to some kinds of cells more than it does to other kinds of cells. Biological evolution makes it possible for cells to change, so the ability of a cell to intensify Reality can improve through mutation and natural selection. A primitive cell would accordingly contain relatively few objects, and these might not interact very well. As the cell evolves, it could acquire more components and they could organize themselves in a way that would provide better information about their mutual locations. To see what course evolution might take, imagine a darkened stage filled with dancers. If the dancers were to just stand in one position, arms at their sides, they would be unable to tell anything about the locations of the other dancers. But suppose you attached the dancers together with

strings, with a string extending from each dancer to every other dancer. As long as these strings remain slack, there is no information provided to the dancers about their mutual positions.

Now tell the dancers to move around. As each dancer moves, she tugs on the strings that are attached to all the other dancers. Suddenly, although the stage is dark, each of the dancers knows something about the location of each of the other dancers. During the period that they are in motion, the uncertainty of the positions of all the dancers, as they appear in the minds of the individual dancers, is reduced to a low value. But you wouldn't want the dancers to move around too much, because everything would become tangled and confused. The ideal thing would be for the dancers to remain pretty much at one location, and just move around enough to tug on all the strings that interconnect them. Imagine an individual dancer as she sways back and forth. The strings that are attached to all the other dancers will tighten and pull in response to the sways. If you had a big computer that could keep track of all the tugs, it could use triangulation-type computations to determine the location of each of the dancers with considerable precision. Even if you do not bother to do the computations, the information about the locations is there. Notice that this information does not become available until the strings are tugged by the moving dancers. Quiescent dancers will not provide this information.

It seems logical that the course of natural selection (Darwinian evolution) would evolve cells toward an increasingly intense Reality. Whereas this is a selective force that would apply generally to all kinds of cells, evolution toward a more intense Reality may have proceeded to a greater degree in some cells than others, so that certain subsets of cells in multicellular organisms may be able to

intensify Reality better than can other subsets of cells. This is a common evolutionary strategy. Accordingly, the general ability of cells to use contractile proteins to change shape is brought to a very high level in the muscle cell, and the general ability of cells to secrete fluids is brought to a very high level in the kidney cell, and the general ability of cells to be sensitive to light is brought to a very high level in the retinal neuron.

The obvious candidate for a cell that has evolved the ability to intensify Reality to a very high level is the neuron. Our bodies are permeated by neurons, which interface our senses with the outside world. Our brains are almost nothing but neurons. Since we appear to use neurons to think with, we tend to assume that neurons are the product of an evolutionary process that reached its pinnacle within the human brain, and that our neurons are superior to the neurons found in lesser creatures. But that is not the case. If you examine neurons in our brains, they are fundamentally similar to the neurons in really primitive creatures, such as nematodes and flatworms. Our brain neurons differ from nematode and flatworm neurons mainly in that our neurons have more projections (dendrites) that provide more inter-neuron connections. But the architecture of the neuron itself, especially its internal organization and the way it operates, is basically the same in a nematode or flatworm as it is in our brain. This means that whatever force of evolution that culminated in the evolution of neurons occurred a billion years ago, and neurons have remained essentially unchanged ever since. It also means that the abilities of humans to think, reason, and create are derived from a neuronal cellular architecture that is the same in humans as it is in flatworms.

The architecture of the neuron and its role in the intensification of Reality.

Let us now look at the architecture of the neuron and see how it is designed in a way that is particularly suited for the intensification of Reality. The neuron is a cell, and like all cells it possesses a membrane that surrounds it. Unlike most cells, the membrane of a neuron is coated with highly organized arrays of ions. On one side of the neuronal membrane is an array of sodium ions, and each one of them possesses a positive charge. On the other side of the neuronal membrane is a layer of potassium ions, and each one of these is also positively charged. Both sides of the membrane are bathed in a salt solution, which contains negative ions, largely chloride ions, that are attracted to the positive sodium and potassium ions. All these charges pull and push against each other, with negative ions being pulled toward positive ions, positive ions pushing against positive ions, and negative ions pushing against negative ions. It is as if they are all dancers that have not only strings with which to tug each other, but also sticks with which to push each other. Both tugs and pushes provide triangulation information. Neurons are quite large as cells go, so the membranes have considerable surface area; so there are a billion or more objects that are tugging and pushing amongst themselves near the surface of a single neuron.

The neuron spends most of its time in a quiescent state, with its membrane resting quietly, covered with its arrays of sodium and potassium ions lined up like a billion dancers arrayed on a great darkened stage, or even more, like huge armies arrayed for battle. Although they are connected by the strings and sticks of electromagnetic forces, in the absence of their moving around, these ionic soldiers

receive little information about the locations of the other ionic soldiers.

Then suddenly there is a cannon shot, and the ranks of enemy soldiers plunge into each other, bayonets slashing. This is exactly what happens when a neuron fires, and the ions charge across the membrane toward each other. For a brief moment, the ranks of sodium ions plunge forward into the ranks of the potassium ions that are themselves plunging toward the sodium ions. Their positive charges are like bayonets that slash at each other as they pass. It is during the brief instant that this is occurring, in which the billions of ions in the neuron are moving among themselves in a highly organized manner, with billions of positive ions pushing other positive ions, billions of negative ions pushing negative ions, and billions of negative ions tugging positive ions, that each of these ions "knows" about the locations of all the other ions because they are all informing each other through septillions and septillions of triangulations. This all occurs within the confines of the molecule-thin membrane of a cell that is a few microns across, so that all of these interactions are occurring over a quao, tuzu-level distance. After the cell has fired, and the ions have exhausted the chemical gradient that gave them the energy to move, it returns to its original state by means of tiny molecular pumps embedded in the membrane, which pump the ions back across to regain their original positions. It is only during the brief instant after the neuron fires, when the ions are charging across the membrane, slashing at each other as they pass, that this highly intense "knowing" occurs. It is at this time that Reality reaches its most intense level. A neuron thus becomes "more real" at the moment it fires than at any other time. This is because of the myriad number of triangulation measurements that occur among its moving parts, that have the effect of reduc-

ing the level of uncertainty of all its parts to an extremely low level.

Thus, despite the uncertainty that is imposed by the Uncertainty Principle, the neuron nevertheless achieves a state of high certainty, or Reality, whenever it fires. The observations made by a neuron are similar to the observations that are made among any group of objects, except that the neuron is unique in having an extraordinarily large number of highly organized interacting components that are extremely close together. This combination of number and closeness of the interacting objects thus sets neurons apart from other groups of objects, such as heavenly bodies, that are comparatively few in number and much farther apart, resulting in a much lower intensification of Reality within solar systems and galaxies than in neurons. *Moreover, since the neuron is a waveform, it can interact with surrounding waveforms through resonance, just as a vibrating tuning fork can induce another tuning fork to vibrate by means of sympathetic resonance. This permits the intense Reality that exists within a neuron to reach outside the neuron and to intensify the Reality of objects that surround it.*

Now that we see what it is that the neuron is doing, I cannot imagine a way to design a system to do it better. To do it better would require even more interactive objects than are found in neurons, and they would have to interact over even smaller distances. Perhaps it is conceivable to do this, but I cannot think of a way to do it. The fact that the neuron has remained unchanged for over a billion years suggests that Nature, with all her enormous powers of evolution and natural selection, cannot "think" of a better way either. It follows that the when a neuron fires, its Reality becomes more intense than that of any other entity in the universe, unless one considers the possibility of grouping neurons together and letting them cooperate. We see that

Nature has done this. Our entire bodies are interlaced with an interconnected network of neurons that integrate the senses of sight, hearing, smell, taste, and touch. Therefore, the firing of a retinal neuron resonates throughout the neuronal network, with each instant of Reality being like a raindrop falling on the ground, which gathers with other raindrops into puddles, which flow into streams, which merge into a river of Reality in our minds.

The Intensification of Reality as a New Force of Nature

Intensification of Reality as a force of evolution.

Let us accept this idea of intensification of Reality for the moment and see how it could constitute a new Force of Nature. I will consider it first as a force that can guide the evolution of living organisms. Darwinian evolution, or "survival of the fittest," tells us that if you have two organisms that are very similar except that they differ in some small way, such as one is taller than the other, or stronger than the other, or smarter than the other, then the one that is taller, or stronger, or smarter may be better suited to survive if it finds itself in a practical circumstance in which being taller or stronger or smarter is an advantage. It is these more fit individuals that have more children, and thus are more evolutionarily successful.

The lesson of the automobile constructed from non-precision parts.

To see how an intensified Reality could contribute to

the competitive fitness of an organism, let us consider how it could contribute to the fitness of a single cell. To do so, I will use an analogy of an automobile that has been constructed from pre-fabricated parts. If the parts are fabricated using a high-precision process, the automobile will operate better than one constructed from parts fabricated using a low-precision process. For example, if the pistons and the cylinders they fit into are not perfectly round, the automobile will have poor performance. The design of the two automobiles, one comprised of high-precision parts and the other comprised of low-precision parts, may be exactly the same; and if you did not know about the difference in the precision of its parts, it would be very hard to tell, just by taking the cars apart and looking at the parts, why one works so much better than the other, especially if the possibility of a difference in precision did not occur to you.

Using this reasoning, one would expect that cells with a more intense Reality would work better than cells with less intense Reality, because their components would be better defined and thus more precise. Just as you would have difficulty in discerning the cause of the automobile with high-precision parts working better than an automobile with low-precision parts, a scientist with no awareness of the importance of the intensification of Reality would not think to attribute cell survival to it. This is particularly likely if the effect on survival caused by a minor improvement in the intensification of Reality is small, and might go unnoticed unless you were looking for it. This is illustrated by looking at what happens if you culture two strains of bacteria that differ only in that one of them grows one per-cent faster than the other. If you were to study each one of them individually, it would be very difficult to detect this difference in growth rate, because it is so small. But if you were to mix these two strains together in the same culture

flask and grow them for many generations, it would not be long before the one with the faster growth rate would completely take over. In fact, growing them together in this way is about the only way to convincingly demonstrate that they do have different growth rates. This could explain why no one has stumbled over the intensification of Reality as a significant force of evolution, since the only way to observe it would be by means of experiments that were carefully designed to detect it. Although the evolutionary effects of the intensification of Reality may be small over the short term, they could be very large over the long term, and constitute a powerful force that moves living systems toward the evolution of complex cells that have a multitude of interacting components.

The evolution of life requires a reversal of entropy.

This idea provides much insight into why the biological world is the way it is, and how life appeared in the first place. There is a scientific discipline called the Study of Chemical Evolution, in which a basic premise is that life is not a wildly improbable accident, but the inevitable result of the fact that the rules governing the universe are highly in favor of life springing very quickly into existence wherever appropriate conditions occur. For example, Chemical Evolutionists argue non-living chemicals such as amino acids and nucleosides that arose through the action of lightning and other natural processes resulted in a dilute "primordial soup" that somehow came together, and by an inexorable step-by-step process through non-living intermediates, finally assembled themselves into a living cell.

One of the vexing arguments against chemical evolution is that it goes against entropy, which is the relentless

tendency of the universe to move toward disorder; whereas living things are the epitome of order. While it is easy to see how living things maintain this tendency toward order now that they are here, it is much more difficult to discern how chemical evolution was able to swim upstream against entropy in the first place. The tendency toward the intensification of Reality is an obvious guiding hand that can account for this. It provides a relentless force that favors the coming together of individual objects to form interactive associations and for these objects to communicate with each other. Even the simplest cell is a monument to the process by which molecules have come together to form highly-organized associations that are in a state of intense communication. All the parts of a cell constantly communicate with all the other parts, the result being that they cooperate to maintain the integrity of the cell and to perform the functions required for it to live. One can see how the force to intensify Reality would cause simple cells to evolve into more complex cells, with even more intermolecular associations, higher organization, and more effective and comprehensive intercommunication among its parts. A scientist, observing these highly evolved cells, could reasonably conclude that the only force involved in the process was that survival of the fittest selected highly organized cells over less organized cells simply because they were more efficient or more effective at deriving food from their environment. For example, it is easy to see how a cell with mitochondria (to provide energy) is more fit than a cell without mitochondria. Up to now, it has been unnecessary to invoke new forces of evolution. It would not occur to me to do so either, if it were not for the compass of "that which cannot be observed does not exist," that has pointed toward the intensification of Reality as a new Force of Nature.

The intensification of Reality points toward an explanation of gravity.

This new Force of Nature may be an explanation of gravity as well as evolution. Of all the forces, gravity has proved to be the most elusive and mysterious. Because of it, all objects of the universe are in communication with each other. Unlike electromagnetic radiation, gravity cannot be blocked by *any* known shielding material. On the one hand, it is a very weak force, and the gravitational pull exerted by the objects that surround us is almost imperceptible. It is only when objects become very large, such as stars, planets, and moons, that the gravitational pull they exert is strong.

Consider that the universe began as matter flying outward from the Big Bang. You would think that the fragments of matter would go straight out like bullets fired from a gun, and their paths would be perfectly straight like spokes extending outward from the hub of a wheel. But instead, every object in the universe appears to have "chosen" to become organized with other objects in the way that galaxies and solar systems are organized. Just as chemical evolutionists are a little hard-pressed to explain how life was able to swim upstream against entropy, physicists are a little hard pressed to say why it is that heavenly bodies tend to organize themselves. The fact that it has happened argues that the tendency to do so is relentless and certain, and must be accounted for.

Intensification of Reality as a resolution of the paradox that the universe becomes ordered in the face of entropy.

Let us now apply the concept of intensification of Reality to this paradox. Consider two of the objects that are flying out from the cataclysmic center, following paths that are like spokes of a wheel. Suppose the spokes are reasonably close together, and that there is a significant exchange of electromagnetic radiation between them. These celestial objects are "aware" of each other by means of these exchanges. If they continue the paths of their respective spokes, the objects will move farther apart, and the amount of electromagnetic radiation will decrease and their mutual awareness will accordingly decrease; and as this process continues, the Reality of these objects will become less intense. However, the tendency for things to evolve toward a more intense Reality would oppose this process, and cause the two objects to deviate from their straight path, and to veer toward one another to restore their mutual awareness. As this happens, their Reality becomes more intense. If the objects move together in order to intensify their Reality, one can see how the trend to intensify Reality would play itself out in the formation of the organized structures of the heavenly bodies (galaxies, solar systems) that we see.

Gravity is not a force.

This suggests that whatever we call gravity, it is not a force in itself, but the consequence of the tendency of objects to intensify their Reality by moving together. The evidence that gravity is not a real force is provided by what happens when you are in an elevator and the cable breaks. Assume that the elevator shaft is extremely long, so you have an opportunity to study the strange situation that exists while you are in free-fall. First of all, you no-

Lie that you are floating in the elevator, exactly like astronauts float when they are in orbit around the earth. If you had a thermos bottle with coffee in it, you could unscrew the lid and try to pour it out. It wouldn't pour, because gravity would exert no effect on it. This is a very curious thing. You have mass, but you float. The coffee has mass, but it won't pour. There appears to be no gravity around at all. You are on the earth, which exerts a very strong gravitational pull, but you cannot feel it; the elevator around you cannot feel it. If you did not know you were in an elevator and what it was doing, it would be very difficult for you to determine that you are in the strong gravitational field of the Earth. If you had sensitive instruments that were designed to detect the presence of gravitational fields, they would detect little except the gravitational fields of the objects that are with you in the elevator. The massive Earth, which is no more than a few feet away, would scarcely betray its existence.

Whereas we ordinarily think of gravity as an unstoppable and unblockable force, one that we cannot in any way diminish by placing insulating materials between objects, we see that by allowing ourselves to fall down an elevator shaft, it vanishes completely. The reason it vanishes may be that it was never there in the first place. This is not true of other forces that are actually forces. Let us say that you have a magnet which is exerting its magnetic force on an iron nail that you are holding near the magnet. Suppose you release the nail and let it fall toward the magnet. While it falls, the situation appears to be identical to your falling in the elevator. But from the perspective of the nail, the magnetic force does not vanish. This is evidenced by the fact that the falling nail cuts through the magnetic lines of force that surround the magnet, and an electrical voltage difference appears at the two ends of the nail. The nail

clearly "knows" it is falling through the magnetic field, and the magnetic field has not vanished from the perspective of the nail in the way that gravity vanishes from the perspective of an occupant of a falling elevator. This is the difference between a real force and a force that merely pretends to be real. A real force will remain if you move around in it, whereas a pretend force may vanish. The fact that gravity vanishes when you fall through it shows that gravity pretends to be a force, but is not.

Having said all this, we are still stuck with the phenomenon of gravity, which is surely real. So if it is not a force, then what is it? I will explain what it is using a rock tethered to a string that you spin around your head. Suppose there is a bug clinging to the rock as you spin it. The bug will feel like it is in a strong gravitational field where "down" is along the axis of the string in the direction of the rock, not toward the earth. You feel this effect when you go on a carnival ride that spins you around in a tight circle. If you close your eyes, you completely lose sense of where "down" is; and while you are riding, you perceive "down" as being outward from the center of the circle. If you break the string that is attached to the rock that the bug is on, the rock would immediately cease going around in a circle, but would instantly head off in a straight line. When this happens, the bug would suddenly feel relatively weightless, and it would now think of "down" as toward the earth. This demonstrates that the only reason that the bug feels "gravity" while clinging to the rock prior to cutting the string is because it is going in a circle, instead of in a straight line. If the string breaks, the bug loses its sense of being in a gravitational field. We can therefore conclude that it is not "gravity" that the bug feels as it circles your head, and what it really feels is the result of

being forced to deviate from a straight line.

Now I can describe what really happens when two celestial objects fly out along their respective spokes. As they move along, they will become increasingly far apart, and their Reality will become less intense. The force to intensify Reality will cause them to deviate from these straight lines, and veer closer together. The objects will "feel" this deviation from a straight line just as the bug feels its deviation from a straight line as it clings to the rock. By means of their mutual awareness, the two objects are making observations of one another, which results in the intensification of their Reality. If they were to veer still closer together, the intensity of Reality would increase still further. They will therefore tend to move together.

One difficulty with this explanation is that the process of moving the objects closer together requires an input of energy, and there is nothing about the intensification of Reality that suggests it can serve as an energy source. It is as if the moving together of objects is because their being together is more probable than their moving apart, just as it is more probable that a roll of two dice will produce a seven than a two. When you roll the dice and get a seven instead of a two, it is not because sevens are more energetically favorable than twos, but because a seven is more probable than a two. We do not have this energy problem when we assume that gravity is a force, and when we see gravity doing work, we say that the energy to do this work is supplied by the "force of gravity," such as when a waterfall drives a water wheel to grind wheat. There is definitely energy there, and we have conveniently accounted for it by stating that it comes from the water "falling by the force of gravity" toward the earth. But if gravity is not a force, it cannot be a source of energy.

So where does the energy to drive the water wheel come from?

I propose that it is ultimately derived from entropy, although it could be derived from some heretofore undiscovered form of energy. To develop the concept of entropy as an energy source, it is widely agreed that the universe, when taken as a whole, is moving toward disorder, or increased entropy. This increase in entropy is "energetically downhill," so anything that taps into this process can use its energy.

Whereas the total entropy of a system always increases, there is nothing that prevents localized low-entropy regions, as long as they are compensated by high entropy regions someplace else. Thus, while the universe as a whole is becoming more disordered, discrete parts of it can become more ordered as long as less order occurs someplace else, and any degree of order can be tolerated as long as the overall books are balanced. So I propose that the energy required to cause the moon to deviate from a straight line and circle around the earth comes not from gravity, since it is not a force, but from the all-over increase of entropy throughout the universe, and is ultimately derived from the fact that the universe as a whole is becoming more disordered as it expands from its Big Bang origin. The entropy of the increasingly disordered universe would thus provide the engine of energy that permits the galaxies to coalesce and life to evolve.

What this scenario does not explain, is the mechanism by which the entropic energy permeates the universe. If the universe is expanding in one part and thus creating entropic energy, in order for this energy to be used to intensify Reality in another part of the universe, there must be a conduit that couples these two parts of the universe

together. Whereas the making of Observations constitutes the transduction of the energy of entropy into Reality, there must be another process that transports the energy from where it originates to where it is needed. In order for it to be instantly available in all places at all times, it must be everywhere and permeate all things. In this respect, it resembles "chi," which is the mysterious force that has been recognized and utilized for thousands of years in the Far East for martial arts and meditative practices. Whereas all objects are thought to possess chi, it is stronger and more concentrated in living things; and the kinds of living things that chi practitioners concern themselves with invariably have neurons. It is thus possible that as we come to understand the intensification of Reality as a New Force of Nature, and its relationship to gravity and the evolution of life, we will also come to understand the basis of these ancient Eastern arts.

Some More Concepts of Waves and Resonance

The lesson of the room where you move the tuning fork with the power of your violin.

I would like to return now to the idea that all objects are waves, and consider another room that contains a tuning fork. In this instance, it is a large tuning fork attached to a resonant pedestal that is standing in the center of the room. You bring a gentlemen into the room and show him the tuning fork. You tell him to inspect it thoroughly, to feel it and to touch it. You strike the tuning fork with a rubber mallet, and it vibrates with a beautiful sound. You give the mallet to the gentleman and tell him to strike the tuning fork. It responds the same way for him as it did for you.

Having completed the demonstration, you escort him from the room for a few moments and close the door. While the door is closed, your faithful confederates rapidly place additional tuning forks on resonant pedestals into the room; one over in the far left corner, one in the right corner; and others here and there. They also place an organized array of tuning forks, arranged from left to right, across the middle of the room.

The entire collection of tuning forks is related in a particular way. The resonant frequency of each of them is selected so that it is different from any of the others. This means that if you were to strike any one of them with a rubber mallet, it would vibrate at its natural resonant frequency, but this frequency is sufficiently different from the other tuning forks that none would vibrate in sympathy. Also, the frequencies are chosen so that none is greatly different from any of the others, just enough different so that sympathetic vibrations do not occur. This means that striking any of them would produce a sound that is not dramatically different from any of the others. Accordingly, if you were to strike one of the tuning forks, and then walk across the room and strike another, the fact that they are of different frequencies is noticeable but not obvious. Someone who was not attentive to details might unconsciously perceive that the apparent difference was somehow caused by the fact that they are in different locations, and not that their frequencies were different.

Now consider what you could do to the tuning forks by playing your violin. By placing your finger at an appropriate position on a string and bowing the string, you could produce a tone with a frequency that coincides with one, and only one, of the tuning forks; and while you bow the string, that one resonant tuning fork would vibrate sympathetically. Suppose you now silence the string, move your

finger a bit, and bow again to produce a frequency that corresponds to the resonant frequency of a different tuning fork. The first tuning fork would stop vibrating, and the second would spring to life. Thus, while standing at a single position in the room, you could cause any one of the tuning forks to vibrate any time you please, just by bowing the appropriate pitch on your violin.

Now about that special array of tuning forks across the middle of the room. These are arranged in order of pitch, with the lowest pitch at the left and the highest at the right. Once again, the actual pitch differences are not very large, but large enough so that none of them will vibrate sympathetically with any of the others. Using this arrangement, you are able to bow a string so that the tuning fork at the far left vibrates. Then you slide your finger up the string so that when you bow the string, it vibrates at a slightly higher pitch. This higher pitch now drives the tuning fork that is standing to the immediate right of the first one, to vibrate sympathetically. The first tuning fork, now that it is deprived of its input of resonant energy, will die out. If you continue this process of shifting your finger and playing successively higher frequencies, the tuning forks will sound in sequence, starting from the left and moving to the right.

You now get the gentleman who has been patiently waiting outside the room, and escort him back in. But before you do, you place a blindfold on him so that he cannot see that the room is now filled with tuning forks. You tell him that he is about to observe an incredible demonstration. You explain to him that the room is exactly as it was a few moments ago when you originally showed it to him (liar!). You lead him over to the tuning fork in the middle of the room (which you had left there for this purpose). You take your rubber mallet and strike it, whereupon the

fork produces the same tone it did previously, and the gentleman has no reason to suspect that the situation is anything other than you say it is. In his mind's eye, he sees a lone tuning fork standing in the middle of an empty room. You escort him to a chair and help him to get seated comfortably.

You now tell him that you are blessed by supernatural powers. You say, "I have a magic violin, and I am a powerful magician. When I draw my bow across the strings of my violin, the magic sound that is produced has the power to reach out to objects and move them around. You saw the tuning fork in the middle of the room that is attached to a heavy pedestal. Nevertheless, as I play my violin, the music will lift the tuning fork and its pedestal, and move it to a different location in the room. I am going to begin by striking the tuning fork with my mallet so you will know exactly where it is starting from."

You step over to the tuning fork in the middle of the room, strike it with your mallet, and it starts to hum. You quickly step back and say, "I will now use the power of my violin to move the tuning fork over to the far left corner of the room."

You place your finger on the string and draw your bow across it to play the pitch that resonates with the tuning fork in the left corner. Just as the sound of the first tuning fork is dying out, the one in the far left corner springs into life. The blind-folded gentleman is astonished at this. He reaches up to remove his blind-fold so that he can see that the tuning fork has moved from the middle of the room to the far left corner. You were anticipating this, and you restrain him. You say, "You mustn't remove your blind-fold. When I move things with the power of my music, I take on the form of a fiendish devil. If you were to see me like this, you would instantly die."

Trembling, he abandons attempts to remove his blind-fold, and sits back to "see" what happens next. You proceed to play notes that correspond to the resonances of the different tuning forks placed at the different locations about the room. The blind-folded gentleman imagines the tuning fork and pedestal moving around, first to the left side of the room, then to the right side of the room, and then to the front of the room. He is truly astonished.

After this has gone on for a while, you say, "Now I am going to do the Grand Finale. With the power of my music, I will levitate the tuning fork off the floor, and then I will swing it back and forth like a pendulum. Absolutely nothing will be holding it up."

You bow the note that corresponds to the tuning fork in the center of the array of tuning forks, which begins to hum. The gentleman "sees" it there in the middle of the room. Then you slide your finger up the string while continuing to bow. The tuning fork to the right of the center one begins to hum, while the center one dies down. The gentleman's jaw drops, and in his mind's eye he sees the tuning fork suspended above the floor and moving to the right. You slide your finger again and bow again, and slide again and bow again. As this proceeds, the array of tuning forks sound in sequence, which seems to the blind-folded gentleman to be the original tuning fork moving through the air. You then slide your finger down, and repeat the process with the tuning forks on the left side of the array. The gentleman "sees" the tuning fork swing to the left. You then begin to slide your finger up and down, up and down, bowing the entire time. This causes the blind-folded gentleman to "see" the tuning fork swinging back and forth in front of him, and he moves his head back and forth as if he is actually watching the tuning fork swing back and forth like a pendulum. In his mind's eye, that is exactly what is

happening. But we know what is actually happening. *Nothing is actually moving at all, except your finger on the violin string.*

There are two important ideas here, both of which have already been mentioned. One is that the violin string is the "Observer" and the tuning fork is the "observed." The distinction between the Observer and the observed is that the Observer is the one that is providing the energy to drive the resonant system. The other is that until you begin to bow the string and cause a tuning fork to vibrate sympathetically, the blind-folded gentleman would be unaware of the tuning fork's existence. Remember that when he came into the room filled with tuning forks, he believed there was only one tuning fork, and since he was blind-folded, he had no reason to think otherwise. Only when you bowed your violin at the resonant frequency of the tuning fork in the far left corner of the room, did that tuning fork become "visible" to the blind-folded gentleman, and in his mind's eye, he actually "saw" the tuning fork "move" to its new location. Because of his preconception about the fact that there was only one tuning fork in the room, and because of your telling him that you were going to move it by the power of your music, he reasonably concluded that when he heard the tuning fork sounding in the far left corner of the room, that the power of your music had indeed picked up the tuning fork in the middle of the room and moved it over to the corner of the room, and that after it had moved, there was no longer a tuning fork in the middle of the room. He believed this because he could "see" the tuning fork in the corner of the room, but could no longer "see" the one in the middle of the room. We know that both tuning forks were there all the time, it is just that they did not become "visible" until they resonated with a waveform with the appropriate frequency. When such an input of energy is available, the tuning fork that resonates with this input will

"appear." To the blind-folded gentleman, those tuning forks that are not resonating in response to an appropriate energy input are "invisible," and as far as he is concerned, do not exist. Those that do exist for him are those that are resonating in response to an input of energy.

Resonance and Waveforms in a Vacuum

Now let's go back to another idea that was presented earlier, which was that a vacuum is not truly empty but filled with a multitude of quiescent waveforms. A quiescent waveform in the vacuum would become visible if it were irradiated by an energy input with the appropriate resonant frequency, just as the tuning fork in the left corner of the room became visible when irradiated with the appropriate resonant energy from the bowed violin string. In principle, the quiescent waveform that would resonate, and hence come into existence, could be any conceivable physical object, just as the copy machine can print any conceivable image, or a computer screen can display any conceivable image.

However, getting an object to appear in a vacuum just by irradiating it with an appropriate energy input is very difficult, which is why we never see it happen. For example, suppose I have a box that is two feet long on each side and contains a perfect vacuum. If I wanted a ham sandwich on a plate to appear in the box by irradiating it with an energy input waveform that will precisely resonate with the quiescent waveform of a ham sandwich on a plate, I would be very hard pressed to figure out how to produce such an energy input waveform. Before I could even begin to produce such a waveform, I would have to have complete knowledge about the location and nature of every atom in

the ham sandwich and plate. It is as if I have a room full of tuning forks, and I want to get them to vibrate in a B-flat minor chord. Assuming that the necessary tuning forks are present, I can do this if I place my fingers at the appropriate places on the strings of the violin and draw the bow across the strings. But suppose my knowledge of musical chords is so rudimentary that I do not know where to place my fingers? With inadequate knowledge of music, I cannot provide the appropriate resonant frequency to get the necessary tuning forks to resonate.

Moreover, the amount of energy that I would have to put into the vacuum in order for the ham sandwich and plate to materialize would be enormous. The amount of energy required can be calculated by Einstein's relation between matter and energy, which is $E=mc^2$. If you were to convert the amount of mass in the ham sandwich and plate totally into energy, it would exceed the amount of energy produced by several dozen hydrogen bombs. You would accordingly have to put this much energy into the quiescent waveform of the ham sandwich and plate in order to get it to materialize within the vacuum. These two reasons, which are the inability to generate the appropriate resonant wave-form, and the inability to imbue this waveform with a sufficient amount of energy, prevent us from implementing this idea. If we could, we would have invented the object replicator, and perhaps the transporter on the Star Ship Enterprise.

Fortunately, we do not have to create a ham sandwich on a plate by irradiating a vacuum, because the problem of creating matter out of a vacuum was solved by the events that occurred in the cataclysmic moment of the Big Bang, during the creation of our universe, when the enormous amounts of energy required to create matter were available. Now that the Cosmic Bow has been drawn across the Cosmic Violin String and matter is here, converting it from one

form to another requires the relatively small quantities of energy that we can attain by burning organic materials or trapping energy from the sun. This is what chemistry is all about, which is the converting of one waveform into another waveform by putting appropriate amounts of energy into a mixture of waveforms so that they become unstable and recombine to produce new waveforms. Because of the ingenuity of human beings to induce appropriate chemical reactions, we have been able to figure out an alternate approach to creating a ham sandwich on a plate that does not involve irradiation of a vacuum. It instead involves our exploiting biological systems to produce pigs, wheat, and mustard seed, from which we create a ham sandwich on a plate by making ham from a pig, bread from wheat, mustard from mustard seed, and the plate from clay. After appropriate low-energy manipulations of these things, we end up with a ham sandwich on a plate. We have thus avoided having to know anything about the collective waveforms of the ham sandwich and the plate, so we did not have to solve the problem of generating the appropriate energy input, because the Big Bang and the processes of evolution took care of these for us.

But now that the ham sandwich is here, there are some new issues that we need to consider. The ham sandwich is a waveform, as all objects are waveforms. Although it is sitting quietly on the plate, we recognize that it possesses an enormous amount of energy in the form of its mass. And let us not forget the idea that a vacuum is filled with a multitude of quiescent waveforms that would "come into existence" if you could only activate them by the input of an appropriate resonant energy. This means that the ham sandwich is surrounded by a multitude of quiescent waveforms, and among them are myriad versions of the ham sandwich, each one a little bit different from all the others.

For example, one micron to the right of the ham sandwich is a quiescent waveform of a ham sandwich that is exactly like the original one in every detail, atom for atom, except for location. There is another one that is one micron to the left and so on in every direction.

Thinking of moving the ham sandwich from the perspective of the Mona Lisa's hand.

Now suppose that you reach out and give the ham sandwich a tiny little nudge, and it responds by moving a tiny little distance, say one micron, to the right. Your experience with the universe and its laws tell you exactly what has happened, which is that when you nudged the ham sandwich, it responded to your nudge by simply moving a little bit, and that after it has moved, it is the same sandwich that it was before it moved. This is so obvious that you do not need to think about it, and you never do. But suppose you are like the little girl standing by the computer watching the drawing of Mona Lisa's hand being moved around the computer screen by using motions of the mouse. After the hand has moved, it appears exactly like the hand in its original location in every detail, except for location. She has no reason to suspect that the means by which the hand moves on the computer screen is any different from how she moves her own hand. But we know that the hand on the computer screen moves by a "drawingand-erasing-and-redrawing" process that appears to move the hand across the screen, but doesn't really. What it actually does is to erase the hand from its original location and then rapidly redraw the hand at a series of intermediate locations, until the final location is reached. The hand in its final location is not the original, but a perfectly redrawn

copy. On a computer with a fast processor, this erasing-and-redrawing process occurs so rapidly that the appearance of the hand actually moving is quite convincing.

Movement of the ham sandwich as a chemical reaction.

Now put this idea of moving the hand on the computer screen by an erasing-and-redrawing process together with the idea that the ham sandwich is surrounded by an multitude of quiescent waveforms, some of which are identical to the ham sandwich in every detail except being at a different location. Suppose that when we give the ham sandwich a nudge, it does not actually "move." Suppose, instead, what actually happens is that the mass and energy that the ham sandwich waveform contains is somehow "dumped" into an identical quiescent waveform that is sitting immediately adjacent to the original waveform. The waveform that is chosen to receive the dumped mass and energy is a very particular one, in that it is identical to the original waveform in every detail, down to the last atom; except it is in a different location. The reason it goes to this one is because it is the one that resonates best with the original waveform. In fact, since it is identical in every detail to the original waveform, it resonates perfectly. This perfect resonance provides the lowest possible barrier to the flow of mass and energy from the first waveform to the next. This low energy barrier can be crossed by the energy input of the little nudge that you gave the ham sandwich. If the ham sandwich is sitting on a smooth surface, say on a perfectly frictionless surface, the waveform of the ham sandwich in its new location can dump its energy into the next quiescent waveform, and the ham sandwich will appear to move farther. Once this process has started, there is no reason it will stop unless you intervene, say by putting your hand in

front of the plate as it slides across the table.

From the waveform's point of view, the process of translocation is rather like knocking down a row of dominoes by pushing over the first one. The first one falls over to hit the next one, which falls over to hit the next one, and so on until all of the dominoes have fallen. An interesting aspect of the falling dominoes is that you need only put in enough energy to knock over the first one. This energy is "saved" in that it propagates down the line to be used over and over. The only way to stop the falling of the dominoes is to go down the line to a domino that has not yet fallen, and prevent it from falling when its turn to fall comes. To prevent this fall would require exactly the same amount of energy that was required to knock over the first domino, neglecting the losses due to friction that occur while the dominos are falling.

When you think about the translocation of the ham sandwich as being, not motion in the sense that we ordinarily think of it, but a succession of waveforms, you realize that translocation of a waveform (an object) is identical to an ordinary chemical reaction, except that the product of the reaction is the reactant waveform that is converted to an identical waveform at a new location, instead of being converted to a different waveform. Conversion to a different waveform is what happens in an "ordinary" chemical reaction. Chemists have studied the chemical inter-conversions of object waveforms a great deal, and they understand what goes on during chemical reactions and what chemical reactions are.

The lesson of the mystery of inertia and momentum.

There is no mystery about chemical reactions in the way that there is mystery about the way that things move.

We are used to the idea that an object at rest tends to stay at rest, and we call this tendency "inertia." We are also used to the idea that an object that is in motion tends to stay in motion, and we call this tendency "momentum." Newton's Laws of Motion put these tendencies on a firm mathematical footing, and physicists and astronomers use these laws to very accurately predict how objects, such as bullets, cars, planets, and so on, will move. However, physicists tell us that they do not actually understand what inertia and momentum are, and cannot account for the fact that an object at rest tends to stay at rest, or an object in motion tends to stay in motion.

Chemists have no such problems with understanding chemical reactions. An ordinary chemical reaction consists of one kind of molecule that has a particular waveform, say a hydrogen molecule. The hydrogen atom reacts with another waveform, say an oxygen molecule, by crashing into it. If a hydrogen molecule hits an oxygen molecule in just the right way (from the right direction, and with an appropriate velocity), their waveforms will combine and reorganize themselves into a new composite waveform, in a way that is rather similar to two sound waves recombining to form a single composite waveform. When hydrogen and oxygen molecules do this, the reorganized waveform will usually be a water molecule. In order get these waveforms to reorganize and combine, you have to invest some energy so you can cross the "transition-state energy barrier" that separates the reactant waveforms from the product waveforms. This investment of energy is called the "activation energy," and it is like pushing a rock up over the crest of a hill. You have to do work to get it up to the crest, but when the rock rolls down the other side, you can recover the energy that you invested when you pushed it up. In the case of making water from hydrogen and oxygen, you get

more energy back out than you put in, because the water has a lower energy content than the hydrogen and oxygen did. This extra energy comes out as heat, such as that which ignited the flames that engulfed the Hindenburg dirigible when it crashed. We therefore think of chemical reactions as involving the combining and reorganization of wave-forms, and if no reorganization has occurred, we do not consider that a chemical reaction has occurred. This is why we have not picked up on the fact that the translocation of the ham sandwich is really a chemical reaction.

Let me explain this in more precise chemical terms. Think of the ham sandwich in its original location as the reactant of a chemical reaction, and the ham sandwich that has moved one micron to the right as the product of the chemical reaction. Both the ham sandwich reactant and the ham sandwich product are waveforms, just as hydrogen and oxygen are reactant waveforms and water is a product waveform. When you use heat (such as from a spark) to push the hydrogen and oxygen atoms together, you distort their waveforms, and push them up toward the crest of the energy barrier that separates the reactant waveforms from the product waveform. If you invest enough energy, you will push them up over this barrier and down the other side.

I propose that you are doing exactly the same thing when you nudge against the ham sandwich. You are distorting its waveform and raising its energy up to the crest of the energy barrier that separates it from its product, which is an identical waveform located just to the right. The waveform of the sandwich resists this nudge, just as the waveforms of the hydrogen and oxygen resist your efforts to raise them to the top of their energy barrier. This resistance constitutes "inertia" but in the case of the hydrogen and oxygen we do not call it inertia, we call it the "activation

energy." Once you have invested sufficient activation energy into the waveform of the ham sandwich, the reaction will cross the energy barrier and go down the other side. In the case of the hydrogen and oxygen reaction, you recover the activation energy and get some more to boot, because the water product is more stable than the reactants. However, in the case of the ham sandwich, the product ham sandwich has precisely *the* same energy content as the reactant ham sandwich, because the waveform of the product ham sandwich is identical in every detail to the reactant waveform except location. This means that you recover exactly the amount of energy that you invested in the activation energy of your nudge of the original waveform of the ham sandwich, no more and no less. Since this original amount of energy was sufficient to push the original waveform over the energy barrier that separates it from the product waveform (the sandwich in the new location), you now have exactly the energy it takes to do the process again. So the product waveform of the ham sandwich at its new location will immediately begin climbing up the energy barrier that separates it from the product waveform at the next successive location. Since this next chemical reaction has exactly the same energy requirements as the first one, the ham sandwich in its new location now becomes the reactant for the next step in the translocation process. It is easy to see that once *you* have invested this activation energy, that the ham sandwich will continue to move indefinitely unless you remove some of the energy you have invested. This energy can be removed by friction between the ham sandwich and the table, or you could place your hand *in front of* the ham sandwich and stop it.

We now realize what momentum is, and see why an object that is set in *motion* tends to stay in motion unless you *stop* it. Whereas "inertia" *is* the activation energy that

is required to get the chemical reaction under way, "momentum" is the activation energy that the ham sandwich now contains, and this activation energy can keep the reaction going. It is also easy to see that the amount of energy that is required to stop the movement of the ham sandwich is precisely equal to the amount of energy invested to get it going. We can also see why it is that big objects have greater inertia (activation energy) than small ones, because their waveforms are more massive and it takes a greater input of energy to distort them and get them to move toward the crest of the energy barrier. Since it takes more energy to cross the energy barrier in the first place, then it takes more energy to stop them once they are under way, which we refer to as "having more momentum." We can also see why it is that when you push an object harder, it goes faster; which is similar to causing an ordinary chemical reaction to go faster by running it at a higher temperature. All of this is completely consistent with Newton's laws of motion. What it does that Newton's laws do not do, and what physics cannot do, is to explain the nature of inertia and momentum.

It follows that if objects move by means of a chemical reaction, then electromagnetic waves, such as light waves and radio waves, also move in this fashion. After all, waves are waves, and they should all move from one place to another by the same fundamental mechanism. Physicists have a problem with light waves, because common waves such as sound waves and ocean waves all propagate through a medium of some kind. Early physics taught that all of space was permeated by a medium called the ether, but the Michelson-Morley experiment disproved this idea. Physicists have since been unable to explain how light travels as waves without a medium through which to propagate. We now see that translocation as a chemical reaction,

in which the energy in the wave moves from waveform to waveform, like a hiker tip-toeing across a creek by hopping from stone to stone, resolves this paradox nicely. It also shows what establishes the speed of light as the limit of how fast something can travel. A thing with mass has a waveform that has to be deformed into order for it to dump its mass and energy into the next waveform. A massless photon does not have to deform anything, but simply must move from waveform to waveform. This movement, although very fast, apparently has a finite rate limit, as do all chemical reactions. I will return to this and other aspects of translocation as a chemical reaction later, and now will press forward into other issues.

The Making of Observations

The lesson of the campfire in the forest.

One of these issues is more about the process by which we make observations, and for this I need to develop a new line of reasoning. To introduce it, I will tell a story.

A person who designs electronic devices had just gotten a job in another city, and packed all of her electronic equipment into her truck and headed off. Unfortunately, she forgot to buy gas, and the truck ran out in the middle of a deserted forest in the middle of the night. Her truck was uncomfortable and stuffy, so she decided to go out into the forest and build a campfire to try and sleep there. As she lay down, she heard noises coming from the forest. She realized she had nothing to defend herself against wild animals and began to get very worried. Although the campfire produced some light, it was not enough to allow her to see what was making the noises. She wished she had a flashlight.

Sitting in the dim light of the campfire, listening to the cacophony of sounds from the forest, she began to get really worried and frightened. Maybe there was a bear coming. Or a mountain lion. And then, as she sat in the warm glow of the campfire, an idea began to form. She had all that equipment in her truck and could use it to make practically anything. The campfire produced heat, which is a source of energy. If she could harness it in an appropriate way, she might be able to generate enough electrical energy to make a flashlight. However, after some mental calculations, she realized that the amount of energy available was so small that it couldn't be an ordinary flashlight, but must be a highly efficient flashlight. She went to her truck and brought back some tools so she could work close to the light of the campfire, and it wasn't long before she had fashioned an elegant little steam-driven electricity generator. Then she thought about the flashlight, and it occurred to her that a laser flashlight would be ideal. Seminar speakers use them as pointers during slide talks. Laser flashlights run off a little flashlight battery, but despite having such a tiny energy source, they produce an intense beam of light that illuminates a tiny spot on the screen. Although there is not much energy, the fact that the beam was so concentrated made it quite bright. After more mental calculations, she realized that her generator would power not only one little laser flashlight, but an entire array of laser flashlights. This was important, because if she were to aim just one laser flashlight at a bear, it would illuminate such a small part of it that she would not be able to figure out what it was. With an array of laser flashlights, she would have a larger field of illumination, and if she were to move this back and forth, shining it first on the bear's shoulder, then on its head, then on its front leg, then on its tail, she would be able to recognize it as a bear.

She worked feverishly for some time to construct the array of laser flashlights. While she was working, she let the boiler of the generator heat up in the campfire, so it would be ready to go. She attached the wires from the generator to the laser array just in time, because there was a loud rustling noise several yards away from the campfire. She aimed the array out into the darkness, and its intense beam fell upon the grinning face of a friendly raccoon. She shifted the beam and saw the raccoon's body. She shifted it again and saw its tail. Satisfied it was just a raccoon, she sighed with relief. Suddenly there was another noise, and she shifted the beam of the laser array to see a chipmunk. Relief again. Another noise, and she aimed the beam to see a rabbit's face. She had to shift the beam a little in order to see its fluffy tail, and while she was looking at the tail, the rabbit's face was in darkness. No matter, she remembered having seen its face, and now that she was looking at its tail, she had no doubt it was a rabbit.

As the night wore on, she continued pointing the laser beam array in the direction of the noises from the forest. Since she didn't have to worry about a battery running down, she just left the laser array on all the time. Might as well use that energy from the campfire, because it would otherwise just go to waste heating up the forest. So in between noises, she would pan the laser array back and forth around the forest. She discovered there was a tree about twenty feet away. She aimed at its roots, and could see them reaching out and grabbing the ground, which was covered with leaves. She moved the beam slowly up the trunk, and as she went she saw a big knot-hole that had been hollowed out by a woodpecker for a nest. She continued until she found a large branch, and then followed it out. At the end was a bird's nest. She wondered if there were eggs in it because she had begun to think about the

fact that she would need to eat, eventually.

As the night wore on, she continued to use her laser array to explore the forest. There was a big boulder beside the tree with a rabbit hole beside it. More food perhaps? On the other side of the campfire was a ravine, and she could see a trickle of water in it. Seeing the water made her realize she was getting thirsty. She continued searching with her laser beam, which was not very big, but quite bright. Although she could not see very much of the forest at any one time, by "painting" the beam slowly back and forth and up and down, she could develop a perfect picture in her mind of the forest, with all its object such as trees, boulders, and rabbit holes, and all its creatures such as raccoons, squirrels, and rabbits. As she did this, she reflected on the fact that it was lucky that she had a pretty good memory, because without it, she would know no more about the forest than that part that she was illuminating with the laser array at any particular moment. But because of her memory, and the fact that she could sample her surroundings in an orderly fashion by gradually panning the beam back and forth and up and down, she was able to develop a perfect picture of the forest in her mind. She realized that this was important, because it enabled her to know where to find food and water, and if a bear or a mountain lion were to appear, she would know in what direction she could run.

She sat down and waited for the dawn. And when it came, she reveled in its glorious beauty. It brought light to the forest, and now she could see everything all at once instead of a little bit at a time, as she was forced to do with the laser beam. She looked toward the tree which was already familiar to her. She looked at the bottom of the tree, and saw its roots grabbing the ground, which was covered with leaves. She then let her gaze wander up the trunk, and she saw the home of the woodpecker hacked out of the

knot-hole. She then trailed her gaze farther up to the tree branch, and then out to the end of the branch where she saw the bird's nest. She wondered again if there were eggs in it. She shifted her gaze to beside the tree and saw the boulder with a rabbit hole at its base. Then for the first time, she saw something she did not already know about. Fresh droppings. Her eyes narrowed, and she concentrated all of her energy on looking at them. They glistened with dampness, so could be no more than a few minutes old. There was definitely a rabbit living in that hole. She was glad to know where to put a snare if it turned out to be necessary. Then she turned and looked across the embers of the campfire to the ravine. The trickle of water was even larger than she had remembered. She could probably get a good drink later. As she stood there, gazing at the ravine-with the tree, the boulder, the rabbit hole, the home of the woodpecker, and the bird's nest all behind her-she thought about how nice it was to be surrounded by the beautiful forest. She took a deep breath, and stretched. She could feel energy surging within her as she stood there beside the dying embers of the campfire. She turned and looked again at the tree. Turned again and drank in the glorious sunrise. And, remembering the episode of the night before, she thought again how wonderful it was to be able to see everything all at once, instead of a little bit at a time.

The neurons of the retina as a laser-beam array in reverse.

There are intriguing parallels between the campfire in the forest and what goes on in our own bodies. All of our observations are made by means of neurons, which reside in the brain, which receive input through nerve-endings

that are suffused throughout our bodies, including the retinas of our eyes. The only energy that is available to neurons for the purpose of making observations is metabolic energy, which is of limited supply, just as the amount of heat available from the campfire was limited. As it is, our brains consume a disproportionate share of the energy consumed by our entire body, and the amount of energy devoured by the brain is fairly constant, no matter what we are doing, even sleeping. To provide the brain with significantly more energy than it already has would be an intolerable burden to our bodies. Just keeping the brain cool would become a problem. The brain seems to have compensated for the limited amount of energy that is available by "paying attention" to only a small part of its surroundings at a time, just as was done with the laser flashlight. Our memories allow us to develop a complete picture of our surroundings, and we can shift our attention from one part of our surroundings to another very rapidly, at any time that we want. This makes us feel that we are looking at everything all at once, but we are not.

Now consider that the eye is constructed remarkably like the laser-beam array. When you look at something, such as the ham sandwich sitting on the table, light that is reflected from the ham sandwich enters the eye and passes through the lens, which focuses the image of the ham sandwich onto the retina. Because the image has been focused by the lens, the light that originated from, say, a tiny crumb of bread on the upper left-corner of the sandwich, is focused on just a tiny part of the retina.

The retina is a densely packed array of light receptors called rods and cones, and each is connected to a dedicated neuron, the axon of which communicates to the neurons in the visual cortex in the brain. So while you are looking at the entire sandwich, whose image covers a large area of the

retina, the image of the tiny crumb covers only a tiny area of the retina. The image of the crumb is therefore not perceived by the entire retina, but only by the small group of neurons that are connected to light receptors located at the position at which the crumb's image is focused. This arrangement of light receptors and neurons in the retina creates a situation that is quite identical to the laser-beam array, except for the fact that the light is coming into the neuronal array of the eye instead of going out of it, as in the laser beam array. Whereas each laser light in the laser-beam array emitted a tiny collimated beam that illuminated a tiny area of, say, a rabbit's face, each neuron of the retina is illuminated by a tiny focused beam of light emitted from a tiny spot on the crumb of the ham sandwich.

There are an enormous number of neurons connected to the retina, which gives it superb resolving power. This means that there is one particular neuron that is scrutinizing, not the whole sandwich or even the whole crumb of the sandwich, but a tiny part of the upper-left corner of the crumb. The only reason we can see the ham sandwich as a whole is because the information provided by all of the individual neurons, each of which is doing the same thing with other teeny-tiny parts of the sandwich, is miraculously assembled into a whole image by your brain.

Intensification of Reality using the metabolic energy of neurons connected to the retina.

Now let's focus on what one particular neuron is doing. That neuron is a waveform. The crumb is a waveform. This means that as a particular neuron is scrutinizing the upper-left corner of the crumb on the upper-left corner of the sandwich, it is in a situation that is greatly like the

one in which you are standing in front of the tuning fork with your violin and bowing the string, in which the crumb is playing the part of the tuning fork, and your neuron is playing the part of the violin. Because your neuron has a source of metabolic energy, it is the "Observer," and it is participating in maintaining a resonant interaction with the crumb, which is the "observed." I would argue that the waveform of the crumb has become more intensely real than if the neuron, with its energy source, were not observing it, because the waveform of the crumb is resonating with the energy output of your neuron. *This is how the observing of something has an impact on its Reality.*

I would now like to suggest a startling idea, which is related to the room with the blind-folded gentleman who was fooled into believing that you could move the tuning fork around the room with the power of your violin. What was really happening was that you made the tuning fork appear to move in his mind's eye by playing different pitches on your violin, which caused different tuning forks to resonate. Now consider that the waveform of the crumb is surrounded by quiescent waveforms. What if your neuron is able to "slide its finger up the string," so that it would resonate with the waveform of the crumb that is lying a little bit to the right of the original one? Perhaps this could induce the original waveform to dump its energy into the one that your neuron is now resonating with, and the crumb would "appear to move" to the right. It would have undergone a motion-type chemical reaction, just as if you had nudged it with your hand.

You are likely to reject this idea, if for no other reason that none of us seem to have the ability to move ham sandwiches around by imagining them in new locations, which is called psychokinesis. But suppose the reason we cannot do this is not that it is theoretically impossible, but because

our neurons cannot muster sufficient metabolic energy to raise the crumb (along with the rest of the ham sandwich, which is being scrutinized by other neurons) over the activation energy barrier that separates it from an adjacent quiescent waveform. It is as if you went into the room of tuning forks with a violin that had strings made of goa-aozerand a bow made of spider silk. The energy output from such a violin and bow would be too low to cause a relatively massive tuning fork to resonate sufficiently to be audible. As you stand over the ham sandwich, concentrating with all your might on the quiescent waveform to the immediate right of the sandwich, your feeble neurons are not able to generate sufficient energy to cause the mass and energy of the ham sandwich to be dumped into this adjacent quiescent waveform, so the sandwich just sits at its original location.

The situation here is analogous to a broadcast-station and a radio that is tuned to the station, with the neuron being the station and the sandwich being the radio. If the radio is too far from the station, its output will be garbled. This can be solved by increasing the power output of the station or by moving the radio closer. If the station is at maximum output, then your only option is to move the radio. When you are scrutinizing the sandwich, perhaps your neurons are simply too far away to have sufficient input power to provide enough resonant energy to the adjacent waveform. You would have to get much closer. No, bending over more to get closer is not nearly enough, because "close" must be within quantum-level distances. It is as if you must bring the radio so close to the station that its antenna actually touches the broadcast tower. This suggests that in order for a neuron to get an object to move by means of psychokinesis, it would have to actually reach out and make contact with it.

It is impossible for our neurons to reach out and make contact with the ham sandwich, since they are confined to the interior of our bodies. However, our neurons do make contact with our muscle cells, and it is our muscle cells that enable us to move things around. If you look at the contact between a muscle cell and the motor neuron that is connected to it, you see that the neuronal fibers are actually embedded in the muscle cell. This is as close as you can possibly get, and if motion by means of psychokinesis is possible, the situation that has been created with respect to the neuron and the muscle cell is ideal.

Before we can understand what happens between the neuron and the muscle cell, we first need to consider what is needed is rather like what is found in industry, where workers move heavy objects around by controlling little levers of machines. A worker can sit at a console of a forklift, and by moving a certain lever, which requires only the merest touch, he can instruct the forklift to lift a Jeep off the floor. By a gentle touch on another lever, he can move the Jeep to the left, and with another touch of a lever, put it down on the ground. The worker needs to exert very little force in order to activate and control this powerful machine.

In order to show how neurons play the role of the worker pushing the little levers of the forklift and how our muscles correspond to the forklift, I need to tell you about an unusual winter sport called curling, which is played on ice, and is popular in Canada. This sport consists of sliding a heavy stone over the ice toward a target stone. The one who can slide his stone closest to the target stone wins. Although the skill of the player who slides the stone is important, he is aided by team members with brooms, who alter the path that the stone takes by sweeping away ice chips, dirt, and so forth from in front of the stone. The stone follows this cleared path because it is the path of least resis-

tance. Aficionados of curling claim it is the sweepers who really determine who wins, not the thrower. This process of determining the trajectory of the stone by sweeping a path is completely different from most games, such as bowling, in which the direction of the ball is determined solely by the thrower. If the only game you knew was bowling, and you were to watch a curling match from a distance, you would probably interpret the actions of the sweepers as giving the stone kicks and nudges, instead of what they were really doing, which was sweeping.

The bowling ball and the curling stone are similar in that they possess considerable energy. They differ in that once the bowling ball is thrown, it has only one possible fate; meaning, the energy that is in the bowling ball can be used up in only one way, which is determined at the moment that the ball is released from the bowler's hand.

In contrast, once the curling stone is released from the hand of the thrower, it possesses a multitude of possible fates that depend on the actions and skills of the sweepers. The curling stone possesses a great deal of kinetic energy, but that energy can be channeled so that the stone can go in many different directions. Moreover, the large amount of energy in the stone can be controlled by the comparatively small amount of energy required to sweep the path in front of it.

I will call the kinetic energy that is in the thrown bowling ball and the thrown curling stone Newtonian energy, because this energy will be expended according to Newton's laws of motion. However, the energy that is in the curling stone is special in that it can be guided to a variety of different outcomes. If a system is set up in such a way that this guiding influence is possible, I will call such a system as one that possesses Curling energy. Curling energy and Newtonian energy are sometimes interchangeable. For

example, if the sweepers decided not to sweep, the Curling energy of the stone would become simple Newtonian energy. When the sweepers sweep a path for the curling stone, the Curling energy in the stone is expended according to the path of least resistance, which is the path that the sweepers have cleared.

A crucial aspect of Curling energy is that it embodies the expression of Free Will and represents decisions made by the sweepers. Simple Newtonian energy has only one possible fate, and if not deflected in its course, the bowling ball will unerringly follow one, and only one, path. Curling energy can access a multitude of alternate fates, because the sweepers can sweep in any way they please, to guide the stone in a multitude of possible directions. It appears to us that the sweepers possess Free Will in deciding what direction to guide the stone.

Our muscles are a beautiful example of a system that possesses Curling energy. This is evidenced by the fact that if someone were to throw a rock at your face, you could instantly raise your hand to deflect it. Although you might regret it, you have the ability to choose not to raise your arm. The raising of your arm is an energy-requiring process, and the energy comes from metabolic energy that is produced and stored in your muscles. A resting muscle can be thought of like a rock that is resting at the top of a mountain that is sloping sharply downward on all sides. Although the rock is resting, a little nudge will send it careening down the mountain, and the path it will take is determined by the direction and force of the nudge that sent it on its way. The nudge need not be powerful, but just enough to set the rock in motion. Since the rock could be subjected to nudges that possess a multitude of directions and forces, the rock has access to a multitude of paths down the mountain.

The question now is how the muscle chooses the direction in which to move. In the muscle, the neuron plays the role of the curling sweepers, but instead of wielding a broom to sweep a path of least resistance, I propose that the neuron intensifies quiescent waveforms of the muscle cell in which it is embedded. In order to move, the muscle cell must contract. Just as the ham sandwich is surrounded by quiescent waveforms, the muscle cell is surrounded by quiescent waveforms that correspond to the muscle cell in every possible state of contraction. In order to cause the muscle to contract, the neuron merely has to intensify the Reality of the muscle cell that is in the contracted position, relative to the original muscle cell. When you attempted to do this with the ham sandwich in order to get it to move, you failed. The reason you failed is that the ham sandwich was too far away from the "broadcast station" (the neuron), and the amount of energy that could be put into the quiescent waveform of the translocated ham sandwich was too small to cause the energy of the original waveform to be dumped into the quiescent waveform. So it didn't move.

The situation with the muscle cell is completely different. The neuron is extremely close to the muscle cell, in fact it is actually embedded in it. Moreover, the muscle cell possesses Curling energy. When the neuron begins to intensify the Reality of the quiescent waveform of the contracted muscle cell, it is like giving a nudge to the rock that is at the top of the mountain, and the direction that the rock careens down the mountain is determined by the direction of the nudge. The neuron exerts its nudge by deciding which quiescent waveform to intensify, and the abundant Curling energy of the muscle lifts its waveform up near the top of the barrier that separates the waveform of the relaxed muscle cell from the quiescent waveform of the contracted muscle cell.

It is a little like the level of a reservoir rising behind a dam during a heavy rain. As the reservoir fills nearer and nearer to the top of the dam, there comes a point when it takes only one more drop of water in the reservoir to cause the water to spill over the top. The Curling energy of the relaxed muscle cell has similarly lifted its waveform to just below the peak of the energy barrier that separates it from its surrounding quiescent waveforms. Even though the amount of energy that the neuron can muster is very small, just as a single drop of rainwater can send the water of the reservoir over the dam, the energy provided by the neuron can cause the energy of the muscle cell to cross the energy barrier and dump it into quiescent waveform of the contracted muscle cell, whereupon the cell becomes contracted, and your arm moves.

The analogy between the rock at the top of the mountain and your muscles is an imperfect one, in that you can nudge the rock in any direction, so the rock can be made to careen in any direction. But because of the way your muscles cells are constructed, the only kind of movement they can make is an energy-driven contraction and a non-energy requiring relaxation. The movement of your arm in a particular direction is not achieved by controlling the direction the muscle cells move, but by coordinating how much each muscle cell contracts. In order for you to move your arm to the left, the muscle cells on the left side of your arm contract more than the ones on the right side of your arm. The amount of coordination that is required to move your arm in a carefully controlled way is prodigious. It requires nothing less than for every neuron to "know" what every other neuron is doing.

This is not as implausible as it seems. Our nervous system is a completely interconnected network. If you pick up a ham sandwich and throw it, your entire nervous system

becomes engaged with the process. The neurons of your eyes observe the sandwich. You keep your eye on it as you see your arm move toward it. You feel your arm move. You watch your hand open. You feel your hand open. Your hand closes on the sandwich, and you feel it squish between your fingers. As it is crushed, you smell mustard and ham. You take aim at a fly on the wall. Your arm moves back in a coordinated motion, then forward. At the precise moment, you release the crushed sandwich and it sails through the air toward the fly. And misses. The reason you missed is that you are not used to throwing crushed ham sandwiches, and your body does not know exactly what to do. If it had been a baseball instead of a ham sandwich, and if you had practiced the art of baseball throwing sufficiently, you would probably have hit the fly.

Moving our bodies by the force of our imagination.

This leads to a completely new way of thinking about how we move and the way we control our movements. Each of us has been living inside our body our whole life, and we know nothing else. We are completely accustomed to the fact that when we want our arm to move, it moves. If you choose to hold your hand in front of your face and wiggle your fingers, you just do it. There is absolutely no sense that there is some kind of computer in our heads sending out digital instructions like to a robot arm. Roboticists are awed by the way we move and control our bodies, move our hands, flex our fingers, grasp objects and manipulate them. When they try to construct robots that do this, the robots produce jerky uncoordinated movements.

When coaches train athletes, they frequently emphasize visualization of what you are doing. If a tennis player

wants to hit a ball to the far left corner of her opponent's court, she does not go through a lot of mental calculations that are somehow downloaded from the brain to the muscles. She just looks intently at the ball and imagines in her mind the racket moving through an arc that hits the ball so that it does in fact sail to the far left corner. She has spent countless hours training her imagination so that this will happen. The greatest athletic performers are accordingly those who have the greatest ability to imagine what they want their bodies to do. It is important that their bodies have the strength and energy, but a perfect body is not enough. The great Babe Ruth did not have a perfect athlete's body. But there was that historic day when he pointed with his bat to the place where he would hit his next home run, and proceeded to do just that. His neurons were so experienced and his imagination so powerful that he could visualize the series of waveforms that his body needed to follow, that would carry the bat to hit the ball to the exact spot in the bleachers that he had pointed to. With his eye fixed on the ball, and with all the neurons of his entire body in complete communication with one another, his body proceeded to move through the series of waveforms whose Realities were successively intensified by the neurons as instructed by his imagination. His muscles, which were brimming with Curling energy, followed the path of least resistance created by this series of intensified waveforms to carry the bat to its imagined destiny, to become real and actual history.

The Path of Perfect Resonance, and the Power of Free Will to Switch from One Path to Another

This line of reasoning has forged a link between our ability

to make observations and our ability to move our bodies, which is in turn the means by which we can exert Free Will on our surroundings. The ability to do this is unique to living organisms that possess neurons. Almost all of the time, future events are solely in the hands of Newton's laws. For example, suppose you stand beside a billiard table and watch while a player strikes a ball with a cue. Once the ball is struck, the course of events is determined solely by Newton's laws of motion. Although it would be extremely difficult to take all factors into account, such as the friction between the balls and the tabletop, and the imperfect elasticity of the balls; it is in principle possible to compute precisely how every ball on the table will behave, at least within the limits imposed by the Uncertainty Principle, which plays almost no role because the balls are so large.

The idea that the motion of objects is actually a chemical reaction, with the energy of an object moving progressively from waveform to waveform, allows us to view this situation from a new perspective. As the ball moves along its Newtonian trajectory, a very particular set of successive waveforms is chosen, which is the set of waveforms that is identical to the initial waveform, atom for atom. Thus, as the ball moves from one waveform to the next, the energy content of each successive waveform is identical to the one that preceded it. This is a unique set of waveforms, and for the ball to choose any other path to follow would require an input of energy beyond that required to breach the energy barrier between waveforms.

Consider now the mechanism by which the particular set of successive waveforms is chosen. It is the same resonant mechanism that occurs when you bow a violin string to cause a tuning fork to resonate. Whereas the violin string and the tuning fork are not identical and therefore do not resonate perfectly, two tuning forks that are identical will

resonate perfectly with one another. Similarly, the waveform of a billiard ball at one location would resonate perfectly with the quiescent waveform of the billiard ball at the next location only if they are identical to each other, atom for atom. Therefore, as the energy of the moving billiard-ball waveform surges up over the energy barrier, the quiescent waveform into which it will dump its mass and energy is the one that is identical, atom for atom, to itself. Because they are identical, atom for atom, they resonate perfectly, and it is their perfect resonance that is responsible for the fact that, as the ball moves from waveform to waveform, the waveforms that are selected are those in which the atomic structure of the ball is constant. This set of waveforms constitutes the Path of Perfect Resonance, and is not just the path of lowest possible energy, but the path that requires no energy at all. That is, once you have invested the activation energy to get the ball in motion, the Path of Perfect Resonance permits the ball to move indefinitely until this activation energy is drained away, usually by friction, or by colliding with another object. Moreover, this Path is the one that results in the fulfillment of Newton's laws of motion.

However, there is a way that the ball can be made to deviate from this Path of Perfect Resonance, and it is by means of intervention by Observers such as ourselves. As you stand by the billiard table, and observe the balls play out their inevitable fates, you have the option of placing your hand in front of a ball and deflecting its course. You could do this at any random moment, and place your hand at any random angle; thus changing the direction and momentum that the ball possesses in a multitude of different possible ways.

As we do this, it seems to us that the manner in which we intervene is something over which we have complete control, and therefore constitutes an act of Free Will. Once

we have exerted this act of Free Will, the paths of the billiard balls will not be the same as they would have been had we not intervened. However, once they have begun along their new paths, they are as immutable and as predetermined by Newton's laws as they were before and constitute a new Path of Perfect Resonance. It is only at the moment of your intervention that something special occurs, and it is at that moment that the balls switch from one Path to another Path. This switch requires an input of energy, rather like the energy that would be required for an automobile to switch from one road to another by climbing up and over the median strip that separates them. The energy-requiring process for switching the billiard balls from one road to the other is initiated by your neurons, which utilize their metabolic energy to observe selected muscle cells in their contracted state, whereupon the Curling energy that the muscles possess provide the bulk of the energy required to drive the conversion of the relaxed muscle cells to contracted muscle cells. When this happens, your arm moves, and the ball switches to a new Path of Perfect Resonance. By this simple act of Free Will, you have changed the Destiny of the universe forever.

0-forces and 0-motion.

I will refer to the power of Observers to perform this switching process as an "O-force." The energy of the force is derived from the metabolic energy of the neuron, and is exerted by the neuron to intensify the Reality of the quiescent waveforms of the muscles cells that it "wants" to see. However, without the participation of Curling energy, this Reality would not be realized. One could say that the 0-force is a small force whose role is to point in the direction

of the selected future, like the sweepers point the direction of the Curling stone by sweeping a path of least resistance. But the force is too small to bring it about all *by* itself. However, because of the availability of Curling energy in the muscles, the future toward which the 0-force of the neurons is pointing is the one that is actually chosen by the muscles, just as the path swept by the sweepers is the one that is chosen by the curling stone.

The motion that results from the exertion of an 0-force can be referred to as 0-motion. 0-motion persists for only the very brief period of time required to switch from one Path to another Path, whereupon ordinary Newtonian motion takes over again. One can see that it could sometimes be difficult to determine if an event is the result of 0-motion or simply Newtonian motion. For example, suppose you are walking down a shady sidewalk, and an acorn hits you on the head. You look up and see an oak tree filled with acorns. You look down and see the ground strewn with fallen acorns. You could reasonably conclude that an acorn has fallen from the tree and hit you on the head, which would have occurred solely as a consequence of Newtonian motion.

However, suppose there are two little boys hiding behind a bush and giggling. They are giggling because one of them had just thrown an acorn in a high arc through the air, to hit you on the head. Prior to its being thrown, the acorn had been lying on the ground by the bush. Unless it had been picked up by one of the little boys and thrown at you, its hitting you on the head solely as a consequence of Newtonian motion was virtually impossible. It was the 0-forces that were exerted by the little boy's neurons to cause his muscle cells to change shape and thus launch the acorn that were responsible. Once the acorn had left the boy's hand, its path was determined solely by Newtonian

motion. But since the acorn could have never have traversed this path without the intervention of 0-forces, its motion through the air toward your head is the result of 0-motion. It often may not matter whether we know if an object is moving as a consequence of 0-motion, or as Newtonian-motion. But suppose you started getting hit by acorns all the time, and you wanted to put a stop to it. If you concluded that the acorns were hitting you solely because of Newtonian motion, you might try to stop it by cutting down your oak trees. But if it is 0-motion that is responsible, cutting down the trees might not help, because the little boys might just throw pebbles instead of acorns.

The Resonant future and alternate futures as a result of 0-motion.

This brings us to a new perspective of the significance of Newtonian mechanics. The entire universe can be thought of as a giant billiard game, in which all the objects in it are moving in response to Newton's laws. This means that objects that are flying outward from the cataclysmic center of the Big Bang are all moving along trajectories that correspond to the Path of Perfect Resonance, and at any instant in time all the objects are located at positions that were dictated by where they were in the previous instant, and where they will be in the next instant will be the result of Newtonian motion. Without an input of energy to deflect objects out of their resonant pathways, the next instant will always be the one that resonates perfectly with the present instant.

The only source of energy that is capable of altering this immutable course of events is the power of observation that is exerted by Observers by means of their neurons. The

importance of this power cannot be overestimated. If there were no Observers to intervene in the course of the universe, it would have only the limited repertoire of destinies that is possible by playing out Newtonian forces within inanimate objects, and if it were not for the Uncertainty Principle, the universe would have only one Newtonian destiny, as dictated by the Path of Perfect Resonance that must be followed by each of the objects within it. It is only by means of Observers exerting 0-forces, which lead to 0-motion driven by Curling energy, that gives the universe access to the multitude of destinies that it may need in order to survive. Perhaps the number of destinies that are consistent with survival is *very* small, and to chose a correct one from among the many possibilities will require the Observers to make highly informed and intelligent choices. If so, the Observers must relentlessly search for the knowledge and understanding that will allow them to select a Future that will fulfill the purpose of their existence. We have always known that we need the universe. Now we see that the universe needs us. We are thus locked in an embrace of mutual need that will last for as long as the universe lasts. How long that is, is up to us.

Part III

The Metaphysics of Observation

We have traveled a long road, and it has taken us to surprising places. We have been guided along this road by our compass, which is the axiom "that which cannot be observed does not exist;" or put another way, everything consists of waveforms that could not exist without the observations that are made of them. By embarking on this road, I originally intended to address classical philosophical questions such as "who am I," "why am I here," "where did we come from;" "do we have a purpose, and if so what is it," "is there a God," "what is the nature of good and evil:" Part I brought us answers to most of these questions, but they depended on philosophical arguments that were derived from the fundamental axiom, and since both the axiom and our logic can be flawed, we cannot have complete confidence in our conclusions.

Clearly, our confidence would be would be greater if we could use the compass to help us derive natural laws. For example, our confidence in the Fundamental Theorem of the Calculus is strengthened by the fact that it can be used to derive the equations that correctly relate the area of a circle or the volume of a sphere to its respective radius. If invalid equations resulted, calculus would be useless. But because calculus provides valid equations, we accept that the principles of calculus are valid, and since these principles rest on the Fundamental Theorem of the Calculus, then the theorem must be valid. Part II represented the attempt to explain certain natural laws from the perspective of "that which cannot be observed does not exist." By looking at everything from this perspective, we are saying that everything about the universe is intertwined with the making of observations.

We have seen that the universe is constructed in such a way that we, as Observers looking through our telescopes back into Time, can actually observe how the universe was

created out of nothingness at the time it was actually happening. We have seen how the fact that material objects are actually waveforms makes it possible for mere observations to intensify their Reality, and to move them around. Remarkably, we have even happened upon explanations of some of the greatest mysteries of physics, such as the nature of gravity, inertia and momentum, and how light waves can travel through nothingness. These insights arose without effort, just as the equation for the area of a circle arises without effort from the Fundamental Theorem of the Calculus. This cannot help but encourage us to believe that our axiom is fundamentally correct, and that our compass is pointing in the proper direction. If this is true, why stop at gravity, inertia, and momentum? Why not continue on to explain the really great mysteries of the universe, such as the nature of the mind and our consciousness, our Souls, and what happens to our Souls when we die? If our axiom is truly robust, then it should shed light on these eternal mysteries.

However, if we are to proceed in this direction, we must fortify ourselves. As we delve into these questions, we must enter the world of the metaphysical, which is littered with misconceptions that constitute a labyrinth within which you can wander lost forever. But when Theseus entered the Labyrinth of the Minotaur, he had a secret weapon: a string that he unwound as he went, and no matter how the tunnels twisted and turned and led off in confusing directions, he held onto the string that could lead him out. We do not have a string, but we do have our compass. As we enter the Labyrinth of the Metaphysical, our compass should lead us toward the truth. As we pass seductive passages, we will not turn down them if our compass points in another direction.

As we proceed through the Labyrinth we must be prepared for surprises, because each of us has preconceptions

about the Soul and the nature of life after death, and these are usually entwined with our religious beliefs. It seems very unlikely that the true nature of these things actually conforms to our preconceptions, especially since people's preconceptions vary so widely. Therefore, any answers that we derive are likely to be so different from what people believe, that many will find them unacceptable, or even preposterous. To proceed along this road, we need to think about the Dimension of Time.

Resonances of Times Past

The lesson of the songbird and the hawk.

We are familiar with Time as an arrow that proceeds in only one direction. As I sit in a chair and contemplate my surroundings, I exist at a particular instant in Time, which is the Present Moment. As I contemplate this, I realize that my contemplations always occur at the Present Moment, but I remember events that occurred earlier. A few minutes ago, I looked out the window and saw that it was a nice, sunny day, and a songbird flew past. As I sit here in the Present Moment, I decide to go for a walk to enjoy the sunshine and songbirds. As I am walking, I see a hawk plummet out of the sky and snatch a songbird out of the air. I have never before seen such a thing, and I am greatly affected by it. After a while, I decide to go back home to think about what has happened.

Now that I am back in my chair, I realize that I am not exactly the same person that I was before I went for the walk. Seeing the hawk snatch the songbird out of the air has changed my attitude about birds and the forces of Nature, forever. Never again will I be able to see a songbird flitting through the air and not think about the hawk.

Never again will I be able to see a hawk without thinking about the songbird. Next time I see a songbird flit past my window, I may decide not to go for a walk, for fear that I will see it devoured by a hawk. From now on, nice, sunny days may give me a sense of foreboding rather than a sense of exhilaration.

I realize that my thoughts at the Present Moment are shaped by events of the Past. These are events, that once they have happened, can never be undone. I can never undo having seen the hawk snatch the songbird. If the events of the Past had been different, my Present Moment thoughts would be different, and what I would do in the Future would be different. I realize that the Past and the Future meet at the Present Moment. The Past is fixed and immutable. There are a multitude of possible Futures, but the one that will actually happen is resolved by what I think about and decide to do at the Present Moment. But I cannot think just anything. I can think only those things that are extensions from my Past experiences. Although my Future actions are determined by these experiences, I believe that what will actually happen is not immutable, but depends upon the way that my Present Moment thoughts interpret the Past, and that there is more than one way that they can do this.

Although the Past has a strong influence on my Present Moment thinking, I believe that it does not prevent me from making choices. I am not an absolute prisoner of my experience with the hawk, and I can decide to go for a walk despite my foreboding. I may go for a walk just to prove this to myself. But as I am walking, I may reflect on just why I made the decision to override the experience of the hawk. It may be that other experiences of my life, other events of my Past, played a significant role in this decision. Perhaps I learned from a teacher that we must conquer our

fears, and it is a bad thing to always avoid doing things of which we are afraid. Perhaps I have had so many enjoyable experiences of walking outdoors that they outweigh the possible unpleasantness of seeing a hawk seize a songbird out of the air. Maybe the idea that hawks catching songbirds is Nature's way will niggle at me, with the result that my revulsion at seeing it happen will diminish.

I begin to wonder if my going out for a walk despite my fear was really a free decision after all. Perhaps my brain is a device with the capability of somehow constantly summing up my whole life's experience and arriving at an answer that tells me what to do from moment to moment of my existence. As I sit in front of the window looking out and trying to decide whether to go for a walk, my brain is not just totting up those things of immediate relevance, such as the recent event of the hawk and the sunny day, but is summing up absolutely everything that has ever happened to me. If my brain is doing this, it is doing it completely without my awareness. Whereas I may be aware of the recent memory of the hawk, I am probably not aware of remembering what the teacher told me about conquering my fears, or consciously factoring in my love of the outdoors. There could be thousands of other things that have happened in my life that are contributing to my decision of whether to go for a walk, but I am not thinking about those things either. I just decide.

As I am in the process of making this decision, I realize that this process goes on during every moment of my waking existence. Everything I do, every action I make, no matter how trivial or inconsequential, is informed and animated by my experiences of the Past. This is proved by the fact that as each of us goes through our lives doing things, we all do them differently. This is clearly a result of our past experiences, because if it were not, we would all do

the same thing when confronted by a particular set of circumstances, and we do not. As I sit in my chair and see a plate of walnuts, I may decide to eat one. Another person might decide not to, perhaps because they have experienced allergic reactions to walnuts. I crack a walnut using the nutcracker that is lying beside the plate. Another person might pick up the walnut and try to crack it in his teeth. I do not do this because my mother told me many years ago what will happen to your teeth if you use them to crack walnuts. I do not think about what my mother said as I reach for the nutcracker, but I do as she taught me anyway.

As I walk down the street, my every action and mannerism is determined by my past experiences. Whom I say hello to, and how I say it. The speed with which I walk. Whether I swing my arms. Whether or not I whistle or sing, or talk to myself.

The lesson of Pygmalion.

If you have ever met an upper-class Englishman and conversed with him, you will see the extent to which this occurs. Absolutely everything about him is "typically English." The way he stands, the way he moves and bends over. The way he holds a teacup. The rhythm of phrases and choice of words: "By Jove!" and so on. That anyone could be a convincing upper-class Englishman without living the life of an upper-class Englishman is preposterous, especially if being judged by another upper-class Englishman. This is one of the lessons that George Bernard Shaw was trying to tell us when he wrote *Pygmalion*. We are delighted by the possibility that it could be done, and are a bit disappointed when we find that it cannot.

The lesson of pretending to eat.

I will give a personal example that amplifies this idea. When I was ten years old, I was given a part in the play *Our Town*, by Thornton Wilder. I played Wally Gibbs, little brother of Emily, the heroine. I appeared in only one scene and spoke only one line (except in the last act, where I had to sit motionless in a chair for what seemed forever). I thought this part would be very easy, but it turned out to be very difficult. It was difficult because *Our Town* is one of those plays with minimalist props. This meant that when Wally sat down at the breakfast table with the rest of the Gibbs family, there were no plates or knives or forks or spoons, and no food. When I learned that we were expected to pretend to eat breakfast, I assumed there would be absolutely no problem. I tended toward the heavy side and always knew exactly what to do when I sat down to eat, so I went into the first rehearsal with great confidence. As I was waiting for my cue to come on, I thought it would be useful to imagine a table full of food so that I would get in the proper mood. I imagined myself sitting there, eating oatmeal and toast, and drinking a glass of milk. When I heard my cue ("There's a mill in *Our Town* too . . . "), I trooped out with Emily and took my place at the table. Much to my astonishment, I had absolutely no clue about what to do. I reached out to pretend to grasp a spoon for my oatmeal and made a clumsy fist that was totally unconvincing. I pretended there was a piece of buttered toast on my pretend plate and attempted to pick it up and put it in my mouth. I made a motion that probably looked like I was picking up a piece of popcorn and trying to kiss it. I thought, I'm only ten years old, and I haven't had as much experience eating as the other actors, who are all college age or older. I watched them, and discovered that they didn't have a clue

as to how to pretend to eat, either.

After the rehearsal, I went home and got out a plate and a bowl, filled the bowl with cereal and fixed a piece of toast and put it on a plate. I sat down and began to eat these things just as I usually did. My hand knew exactly how to grasp the spoon, and I looked at my hand carefully while I held it. I had no idea that I held a spoon that way, with the shaft of the spoon cradled neatly between my first two fingers and my thumb resting lightly on the top. I suppose I concentrated on learning to do this at one time, but I couldn't remember it. I took the spoon out of my hand and tried to mime the motion of holding it, and found that it was surprisingly difficult to do, even though I had actually held the spoon just moments before.

It was several years after this that Marcel Marceau burst on the theater scene. His ability to mime was astonishing. He would stand in front of the audience and appear to be donning a pair of invisible gloves. Other times, he would swing an invisible umbrella or lean against an invisible fireplace. Although all of us can don real gloves, swing a real umbrella, and lean against a real fireplace with casual ease, the ability of Marcel Marceau to convincingly appear to do these things without anything to don or swing or lean against, accorded him the status of a performing genius.

This is actually rather strange. Current thinking says that our minds are like computers that keep memories in compartments in our heads somewhere, and make decisions by computations based on programs provided by our genes and our experience. When we don gloves, it is thought that we are recalling a kind of computer program that carries us through the process step by step. We believe this about ourselves partly because of the success roboticians have had in programming computers to do industrial tasks, such as install screws and paint car fenders and

doors. We could program a computer to don a pair of gloves. Such a program would instruct a robot arm to move over and pick up gloves that had been placed in a strategic spot. The robot hands would then go through an intricate set of programmed motions in order to put on the gloves, and would appear to be doing it in the same way that real hands don gloves.

The interesting contrast between robot hands and real hands is that if you did not provide gloves at the strategic spot, the robot hands would nevertheless reach out and flawlessly pretend to pick up the gloves that were not there, and then flawlessly perform the motions required to put on the gloves. The motions it would perform with and without the gloves would be absolutely identical. Real hands, however, are largely incapable of going through the proper glove-donning motions in the absence of the gloves, which shows that the processes are not the same. If they were, we would all be able to mime like Marcel Marceau, and we cannot.

Deviations from the Path of Perfect Resonance.

In order to understand what is going on during the donning of gloves by real hands, we need to consider that the motion of objects is a chemical reaction, and that in the absence of O -forces, the reactions always follow the Path of Perfect Resonance, and can deviate from this path only when an O -force is exerted by an Observer. This results in O -motion, which constitutes the switching from one resonant pathway to another one, and once the new resonant pathway has been selected, a different future begins to unfold. Put in this light, we can see that the act of donning a pair of gloves involves the selection of an intricate series of

resonant pathways, in which each pathway merges seamlessly into the next. It is impossible for us to select this intricate series of pathways unless we actually have the gloves in our hands. But with the gloves in our hands, we sense what the first step in the pathway is, and once we have taken this step, we see what the next step is, and the next, and the next, until the gloves are donned.

When I pick up a pair of gloves with the intention of putting them on, the sense of what to do first is complete, almost like there is a kind of resonance with the first step in the process. After the first step is complete, there is a resonance with the next step, and so on until the gloves are donned. This resonance is a consequence of past experience, and the first time you put on gloves, it does not occur. The more experience *you* have with donning gloves, the better this resonance becomes. This resonance due to experience competes with the Path of Perfect Resonance that the gloves would otherwise have. As the gloves rest on the table, they are in the grip of Newton's laws of motion and are thus trapped in the Path of Perfect Resonance that these laws provide. They can deviate from this path only by the intervention of an Observer. If you come into the room and see the gloves, the sight of them resonates with your experiences, and you know what they are for. As you pick them up, your neurons exert 0-forces on your muscles, which perform 0-motion, to cause the gloves to deviate from the resonant pathway that they were in, then through an entire series of resonant pathways, each of which resonates with your experiences. All of these resonances combine in a kind of harmonious chord, the result of which is that the gloves are on your hands. Whereas all an 0-force can do is to switch an object from one resonant pathway to another resonant pathway, the argument I have just given says that the selection of each new resonant pathway is also the

result of a resonant process, and that at any instant, the next future instant that will unfold is the one that resonates best with the current instant. This means that the Future that will occur is the one that resonates best with the Present. When an Observer is present, the most resonant Future will often be quite different from when there is no Observer.

Living the Resonant Life.

Let us develop the idea that the actions we take are the result of resonance with our past experiences. One of the most intriguing aspects of our minds is that we seem to have the sum total of our life's experience available to us all the time. When I walk down the street and recognize a good friend, even if it is a friend that I have not seen for several years, recognition seems instantaneous. I have no sense at all of my brain rapidly sorting through all the faces I have ever known trying to find a match. Such a sorting process is what computers do when they are programmed for face recognition, and it is a slow process. The fact that we seem to recognize faces almost instantaneously is rationalized by assuming that our brains are super-fast computers.

As I sit in my chair pondering whether to go for a walk, it does not seem to me that I am in the process of reviewing the events of my life in a serial fashion, looking for lessons that will tell me what to do. That is what a computer would do, with some kind of rule book it would look through, and then it would apply some kind of weighting system to the rules, and compute a decision of what to do. What I feel as I ponder my decision is that I have access to my total life's experience, and all of it is going into determining what my

decision will be. I do not feel that I am reviewing all of those experiences one by one, but they are simply there, and my decision is the consequence of all of them. I simply feel these experiences, and decide.

The mind as a resonant musical instrument.

I propose that what is happening is that my decision is the one that provides the best resonance with my total life as it has existed up to the present time. The decision to go for a walk will "feel right" to me in the same way that the final resolving chord of a well-written symphony "feels right." The perfect resolving chord is the one that best sums up the spirit of the entire symphony. If you were to walk into the auditorium while the final chord of a symphony is played, it would mean nothing to you. But the audience, who has sat and listened intently to every twist and turn of the melodies and inventions in the music, will feel great satisfaction with this perfect conclusion. The instant before they hear it, they know exactly what it will sound like, even if they know nothing about music or composition. This final chord is the one that resonates best with the entire symphony.

We can think of our entire life as a symphony, and each successive chord that is played is the one that resonates best with what has come before. When I decide to go for a walk, this decision is the one that resonates best with the events of my entire life. If this is the process by which I decide whether to take a walk, it must be the process by which I do everything. Our lives are made up of a series of events, each one leading into the next seamlessly, and as we approach each event in our lives, the action we take is the one that resonates best with our lives up to that moment. And once we have passed that moment and proceed to the

next, the previous moment becomes part of the symphony that will resonate with future moments. People often use the expression "That really resonates with me." Maybe this expression is not just a metaphor, but is literally true.

If this idea has any validity, it implies that the mind is more like a musical instrument than it is like a computer. I find this an aesthetically pleasing idea. Quantum Mechanics has told us that all objects are waveforms, and this includes our brains. If we make decisions as a consequence of resonant responses, then there must be a mechanism by which events of the Present can resonate in our minds with events of the Past. To gain an understanding of what this mechanism might be, we need to consider how the waveform of our brain exists through Time.

The Waveform of the Hydrogen Atom As It Exists through Time

Since the brain is a very complicated waveform, it is useful to develop the concepts we need with a much simpler waveform, such as a hydrogen atom, which consists of a single proton and a single electron. Despite its simplicity, it is the foundation on which our understanding of matter through Quantum Mechanics is built. If you open any chemistry textbook, you will find the hydrogen atom described in great detail. The electron is especially important to chemistry and is much more profound than is implied by the picture of a little marble-like electron orbiting around the proton nucleus. Whereas it is convenient to refer to electrons and protons as particles, they are not discrete objects, but are best described by the wave equations of Quantum Mechanics, which show that these "particles" are really wave-like probability distributions. This means that the hydrogen atom is a composite waveform, since it

consists of an electron waveform and a nucleus waveform. Since all atoms have the same basic design as the hydrogen atom, these ideas extend to encompass all material objects, including ourselves.

The entire discipline of chemistry focuses on the electron, because it is the electron that permits the atom to participate in chemical reactions, such as the one where you mix hydrogen atoms and oxygen atoms and heat them up so that water is formed. This happens because the electron waveforms, called orbitals, undergo changes in shape during a series of separations and mergings called bond-breaking and bond-forming. Water results when the electron orbitals of two hydrogens merge with the electron orbitals of an oxygen. Our bodies have resulted from the appropriate mergings of the myriad waveforms of the elemental atoms from which we are made.

Much has been learned by studying what happens to the electron of a hydrogen atom when you put energy into it. In its lowest-energy state, the electron orbital waveform is a simple sphere with the proton nucleus at its center. However, when you put energy into it by hitting it with a photon, the electronic orbital can become larger and change to a dumbbell-like shape. This dumbbell can stick out in several different directions, which gives the electron several options of what to do when it gets hit with a photon. If you hit this dumbbell-shaped waveform with another photon, it can get still larger and change shape again; this time to something that is a little like a pinwheel. Further zaps with photons can cause these waveforms to change to still other sizes and shapes. These energized waveforms are unstable, and at any moment, they can throw away the energy that they have absorbed by emitting one or more photons. When this happens, the waveform will collapse back down to a shape corresponding to lower energy states, and will

eventually again become a simple sphere.

Although a hydrogen atom is so small that we cannot see it, we can nevertheless imagine what the hydrogen waveform would look like while it is being zapped by photons. At one moment, the hydrogen waveform is a sphere. A photon hits it, and it becomes a dumbbell shape. Another photon hits it and it becomes a dumbbell shape pointing in a different direction. Another photon hits it and it becomes a pinwheel shape. It gives off a photon and becomes a dumbbell shape. A photon hits it, and it is a pinwheel again. A big photon is given off and it becomes a sphere. This process will continue as long as a source of photons is available. One can thus imagine a hydrogen atom waveform being irradiated with a beam of photons. It would appear to do a kind of belly-dance, swelling and shrinking, first poking out one direction and then another.

As we look at the belly-dancing hydrogen atom, we realize that we are not thinking about it very deeply, because we are only considering it in terms of the Present Moment. It actually exists as a continuum through Time; from the Past, through the Present Moment, and into the Future. To make an examination of the hydrogen waveform through Time as convenient as possible, let us imagine that the waveform is drawn on a computer screen, and that movement of the image of the hydrogen waveform across the screen represents its movement through Time, instead of through space. If the waveform moves to the right, it moves forward in Time. If it moves to the left, it moves backward in Time. Since Time is an arrow that moves only in one direction, the only way we can expect to see the waveform move on the screen is toward the right. To move it toward the left would represent a violation of natural laws as we know them, since that would require that the

hydrogen atom move backward in Time.

Let's start with the waveform at the far left of the screen. Now let it move toward the right of the screen, which represents its movement forward in Time. But before it moves, let's take a close look at the hydrogen waveform. The waveform looks like a sphere, because it is at its lowest or "ground-state" energy. We start the clock ticking, and the waveform begins to move to the right, through Time. Whereas our ordinary experience would cause us to expect to see a sphere move toward the right, we can tell our computer program to not erase the old images as it draws the sphere in successive positions across the screen. That is, instead of the usual erase-and-redraw method of moving, the program will just redraw the image at each successive location, but not erase the old images. So instead of a sphere moving to the right across the screen, what we see is a cylinder that appears to be growing toward the right.

We can sit down in front of the screen and watch the progress of the cylinder across the screen. As we watch it growing steadily toward the right, it reminds us of a growing tip of a tree-root, moving through the ground in search of nutrients and water. The right end of the root-tip, which is spherical, represents the Present Moment. The cylinder that extends behind this root-tip represents the Past. As the root-tip moves forward, pixel by pixel, it is moving into the Future, but as it moves, the Future becomes the Present.

If it were a real root-tip instead of just an image on a computer screen, the root-tip could shift its direction of growth at any time, thus allowing it to seek better nutrients or to avoid a rock. If you were to dig up a real tree-root and look at it, you would see it as a crooked cylinder, with each crook representing a "decision" by the root-tip to grow in a

different direction. As you look at the root, you realize that it contains within its gyrations a perfect historical record of the root's lifetime, with each twist and turn of the root representing what the root-tip had done in response to the opportunities and difficulties it had encountered. Moreover, the only way the root-tip could respond to these opportunities and difficulties was to "choose" the direction in which it would grow next. It could not in any way alter its previous twists and turns, since those were fixed in the substance of the root that had already been laid down. Only the tip of the root, which exists at the Present Moment, is in a position to respond to opportunities and difficulties. Once this response has been chosen, and the root-tip moves off into the chosen direction, the root that is left behind will remain as an immutable record of the history of the decisions taken by the root-tip. In order for us to see this history, we need only to dig up the root from where it is buried and look at it. But whereas we can look at it all we want, there is no way we can change it. The only thing that can alter the shape of the root is the living root-tip while it exists at the Present Moment. Once the root-tip has decided what to do, there is no way to go back and erase or change the twists and turns of its Past. It can only move forward into whatever new Future it has chosen.

As we sit in front of the computer screen watching the hydrogen waveform progress across the screen, we decide that it is a pretty uninteresting show. We recall how we had been able to get the hydrogen waveform to do a belly-dance by firing photons at it, which caused the spherical waveform to absorb energy and change into different shapes. Firing photons at the waveform on the computer screen would make it much more interesting to watch. The computer programmer had anticipated this and had included the capability of our being able to aim: a photon gun at the

hydrogen waveform on the screen and zap it with photons, whereupon the waveform would change its shape according to the rules of Quantum Mechanics. We take casual aim at the cylinder with our photon gun and pull the trigger. Nothing happens. After a few moments of reflection, we realize that nothing happened when we zapped the cylinder with photons, because the programmer included the laws of the universe in the program, and one of these laws is that Time is an arrow and always moves forward and never back. Therefore, the only part of the hydrogen waveform that we can change by zapping it with photons is the spherical portion at the far right, which is the part of the waveform that exists at the Present Moment. The rest of the cylinder that extends to the left of the Present-Moment sphere resides in the Past, where we cannot affect it by firing photons at it.

So we must content ourselves with firing our photon gun at the spherical portion of the cylinder that is at the far right, and when we do this, we can make the waveform do its belly-dance. We fire a photon, and the shape at the extreme right of the cylinder changes its shape, to say, a dumbbell. Another photon, another shape. We wait a bit, and the absorbed photons are emitted, and the shape returns to a lower-energy state, say a sphere. As we do this, the Present Moment waveform continues moving toward the right, through Time. As it moves, it leaves its Past behind in the form of a cylinder. But now that the Present Moment part of the waveform is doing a belly-dance, the Past waveform is no longer a featureless cylinder, but a highly textured surface. It undulates and is covered with all kinds of bumps. Each hill and valley on this textured surface represents what the hydrogen waveform did in response to being zapped by a photon. When it absorbed a photon, it changed shape, and this shape is preserved in the

historical record of the textured surface of the cylinder. When it emitted a photon, it changed shape again, and this event is also preserved in the historical record of the textured surface. Just as with the root with its growing tip, once this historical record has been laid down, we no longer have the ability to alter it. As we sit in front of the computer screen, looking at the textured cylinder, we realize that the way it appears was determined by what we did with the photon gun by firing it at the Present-Moment growing root-tip of the hydrogen waveform. But once the Present Moment has progressed into the Future, we cannot alter the textured surface of the Past. We can look at it, just as we looked at the root we dug up out of the ground. But we cannot change it.

The only way to change a waveform is to put energy in or take it out.

The reason we cannot change it is that there is no way to put energy into the Past waveform, or for the Past waveform to give up any energy. A hydrogen atom waveform is an eternal thing. If you put no energy into it and take none out, it will stay exactly the way it is forever. The only opportunity we have to put energy in, or for energy to come out, is at the Present Moment. Once the Present Moment has moved into the Past, we have no access to the waveform. We can change the Future of the waveform by putting energy into it by zapping it with photons at the Present Moment. Or the waveform will emit photons. If energy is put into the Present-Moment waveform, or is emitted by the Present-Moment waveform, these events of absorptions and emissions are recorded in the textured surface of the Past waveform.

We now see how important the Present Moment is. It is all-powerful in determining the Future. But it is helpless in altering the Past. We also see how important energy is. If a conduit of energy, either in or out, is available to a waveform, it can undergo changes. If there is no conduit for energy, then the waveform must remain as it is forever. This conduit exists only at the Present Moment.

The hydrogen waveform as a Resonant Instrument.

Let us now manipulate this hydrogen waveform some more. Up to now, the way that I have been zapping the Present-Moment part of the waveform with photons is by aiming my photon gun at it and pulling the trigger. The pattern on the historical record of the textured surface is therefore nothing more than the blips and undulations that represent these arbitrary zaps. Suppose instead, I were to hook my photon gun up to the speaker wire of a record player that was playing a recording of Beethoven's ninth symphony. I could attach the speaker wire to the photon gun in such a way that it would emit photons in response to the music, so that the pattern of photon pulses, in terms of their frequency and intensity, were reflected in the frequency and intensity of the signal coming out the speaker wire. If I aim my photon gun at the Present-Moment hydrogen waveform, it will be impinged by a stream of photons whose frequency and intensity are determined by Beethoven's music.

The hydrogen waveform will perform its belly-dance as usual. But this time, the movements and rhythms of the belly-dance will be in response to the music of Beethoven's ninth symphony, instead of my arbitrary trigger pulls. As the waveform moves to the right through Time, the growing

root-tip will be undulating furiously in response to the music. The textured surface that is laid down, extending into the Past, will retain a record of these musical undulations. If we examined the textured surface closely, we could probably even identify certain parts, and we could scan along it and see where the tempos pick up and then slow down. Whereas our looking at this Past waveform can give us a rough idea of what is going on with the music, it is clear that there is much more information there than we can discern with our eyes. It is easy to imagine that one could design a play-back device that could move along the textured surface, and in a manner similar to a needle following the undulating groove of a record, extract the information that is recorded there and use it to reproduce the music. The signal could be amplified and put out through a speaker, and we would hear Beethoven's ninth symphony.

Since we are manipulating this waveform with our minds, we can do other things with it. Let's imagine that the waveform has been converted into a physical wooden object that we can hold in our hands, just as we can dig a tree-root out of the ground and hold it in our hands. If we were to caress the surface of the waveform, we would feel all the bumps and undulations of Beethoven's ninth symphony. We examine this lovely object from every direction. To look at it and feel it is aesthetically pleasing because it is filled, not only with the creativity of Beethoven's genius as a musician and composer, but also with the creativity and musicianship of the conductor, along with the members of the orchestra and chorus, whose performance of the symphony was also preserved in the recording that you had played into the photon gun.

Out of respect for these things, you want to do something suitable with this marvelous embodiment of human creativity. Since it is made of wood, you decide to hollow it

out. So you go to your workshop and get some tools, and ream out the wooden center, so that it is hollow from one end to the other. You do this very carefully so that you do not disturb the intricately textured surface. Now that you have done this, the waveform reminds you of a musical instrument, like an oboe or a bassoon, or a clarinet. So you fashion a mouthpiece for this instrument, one that has a reed. You insert this mouthpiece into the end of the hollow wooden waveform, raise it to your lips, and blow on it, like a clarinet. Just as with a clarinet, the mouthpiece reed vibrates, and in so doing, causes the column of air inside the instrument to vibrate. A beautiful resonant tone is produced by this lovely instrument, and you are delighted.

Because this is an instrument of unusual origin, you begin to think deeply about its qualities, and what is happening as you play it. Your blowing on the reed does two things. It is a source of energy that is provided by the force exerted by compressing your lungs with your abdominal muscles. The reed sets up a complex pattern of vibrations, and these vibrations are transmitted into the air column within the wooden instrument. The air column is like a vibrating violin string, in that it has a specific length and is composed of a particular material, and is therefore capable of vibrating only at certain frequencies, which include its resonant frequency and its harmonics.

As the column of air vibrates, the vibrations penetrate into the wood that surrounds the air column, and the wood begins to vibrate. But the vibrating wood has the same constraints on the frequencies at which it can vibrate as do a violin string and the air column; and these are the frequencies at which it resonates. The frequencies at which the wood resonates depend on the usual things, which are its size and shape, composition, stiffness, and so on. Because you have hollowed out the wooden waveform, the sub-

stance of the wood consists mainly of the textured surface of the waveform, so the frequencies at which it can resonate are strongly influenced by the textured surface. You notice as you blow on this instrument that the tone it produces is particularly rich and beautiful, and much more complex than what is produced by an ordinary instrument, such as a clarinet, which has a relatively featureless surface. As you continue to blow, you enjoy the feel of the vibrating wood in your hands. You press it against your chest as you blow it, and you can feel the vibrations throughout your body. You think about how exciting it is that what you feel is not just ordinary vibrations, but a kind of distillation of Beethoven's entire ninth symphony, Beethoven himself, and the musicians who interpreted his work. You also think about how you could create other instruments in the same way. Instead of converting Beethoven's ninth symphony into a wooden waveform, you could use the music from Mozart's *Magic Flute*. If you were to play this new instrument, the vibrations you would feel would come from the soaring aria of The Queen of the Night, and the plaintive song of Pamina.

As you think about these things, another thought occurs to you. Suppose you were to take your Beethoven's ninth waveform and put it back onto the computer screen, but instead of its becoming a computer image, let it remain as a hollow cylinder of wood with resonant properties. Now that it is back there, you think again about its being a waveform as it exists through Time, and that the textured surface of the waveform is a kind of memory of Beethoven's ninth symphony that begins at the far left and extends toward the right. Now suppose that you decide to record Beethoven's ninth symphony a second time. Remembering that your record player is still attached to the photon gun, you place the needle at the

beginning of the record, pick up the photon gun, and aim it at the Present-Moment part of the waveform that is at the far right. When the symphony begins again, the photon gun again sends out photons in response to the mu-sic, which impinge upon the right-most part of the waveform, which begins to do its belly-dance exactly as before, and a second copy of the symphony now begins to be laid down on the textured surface that forms behind the belly-dancing mouthpiece of the waveform. This second copy is exactly like the first one, except that it is displaced toward the right end of the waveform whereas the first copy is at the left end of the waveform, which reflects their difference with respect to Time.

Recalling "memories" stored in the wooden waveform.

But now, a new aspect has been added to the situation. Recall that the waveform is constructed of a hollowed cylinder of wood, and is therefore a resonant musical instrument. When the mouthpiece of this instruments vibrates, the entire instrument resonates, and the resonances are vibrations which mimic the ones that the mouthpiece is making. Imagine now that you play the first measure of the Symphony. The belly-dancing mouth-piece is undulating in response to the music of the first measure, and these undulations will be transmitted throughout the instrument by means of resonating vibrations. Remember that two tuning forks that are of identical construction will resonate perfectly with one another. As the belly-dancing undulations produce the second recording, they lay down a textured surface that has an identical counterpart at the far left of the instrument. Based on the principle of the identical tuning forks that resonate perfectly with each other, as the surface that rep-

resents the first measure is laid down for the second time, the vibrations that are producing the second recording will resonate perfectly with the substance of the first recording. Therefore, as the second recording is being laid down, the first recording will resonate in response as the recording process proceeds. This resonant response constitutes a kind of "recollection" of the earlier recording process. Seen in this light, the first recording of the symphony constitutes a "memory;" and the process of making the second recording "recalls" the memory.

This situation is reminiscent of what goes on when we remember events. Whenever we experience something that is very similar to something that has happened previously, we tend to recall that previous experience and everything associated with it. Suppose I am sitting in my living room and play a recording of Beethoven's ninth symphony. As it begins, I am liable to recall attending a live performance of the symphony. This recollection is complete with respect to where and when I saw the performance, who I went with, and probably what I had for dinner afterward. As the recording plays, my memories track it, measure by measure. When the recording ends, I remember standing on my feet, applauding with all my might, and bravoing. After the recording has ended and the record has been returned to its jacket, I continue to remember the events that unfolded after the concert; and the memories are so real that they are almost like watching a movie, in full color and sound.

Our minds are filled with vivid memories like this, but the only way that we can recall most of them is to experience an event that evokes the memories. It is an intriguing idea that our memories consist of our experiences as recorded in a waveform, and that we remember things through a process of resonating with these waveforms.

To extend the analogy of the brain acting as a resonant

musical instrument, consider that in the early days of making orchestral recordings, a microphone would be placed in front of the orchestra, and the sounds it picked up were recorded. When these recordings were played, the only instruments that could be heard clearly were those that were near the microphone, so the methods by which orchestral recordings are made have evolved greatly. Today, recording engineers will distribute microphones throughout the entire orchestra, and will place certain ones in strategic locations. One in front of the first violinist, and one for the first cello. One for the piano and one for the harp. If the oboe has an important solo part, it gets its own microphone. The same for the timpani and the cymbals. Each of these microphones will have its own recording track which the recording engineers will monitor during the recording session, and each track will be recorded separately. In making the final recording, the engineers will adjust the levels of each of these tracks, and then they will be mixed together. The final recording that you buy consists of a single mixed track, or two tracks if it is stereo, which is converted into an undulating groove, such as is found on a conventional record, or converted into the digital form found on a compact disk.

Our brains are constructed along remarkably similar lines and appear to employ a remarkably similar strategy. The brain is not confronted by a single input that represents everything, but is compartmentalized so that we receive input along separated tracks. Just as each microphone in the recording studio feeds into a separate recording track, each of our senses is monitored by a specialized part of our brain. We have an olfactory lobe that monitors the input from our noses. There is an auditory area that is devoted to input from our ears. There is a part devoted to vision, and this is fairly large because the input from our

eyes is enormously complex. There is also a part that receives input from our taste buds, and a part that monitors touch. As studies of the brain have progressed, it has been discovered that there are also parts that seem devoted to input from our emotions, such as the amygdala; and a part that seems particularly involved in the "what" of our experience, which is the hippocampus. A person who has had his amygdala destroyed by surgery or an accident cannot recall how he felt when he had a certain experience. A person who has had his hippocampus destroyed cannot even remember having had the experience. But if his amygdala is intact, he may remember the emotion of the experience, especially if it is fear, despite not being able to remember the experience itself. Our cerebral cortex seems to be devoted to the process of "thinking" or "reasoning," whatever those are.

Since all objects are waveforms, our brains are waveforms. And each part of the brain that is devoted to a particular input, such as the visual cortex or the olfactory lobe, is also a waveform. As these waveforms of our brains receive input from our sensory neurons, they undergo changes in response to these inputs. Just as the hydrogen atom waveform does a belly-dance in response to photons that zap it, the waveform of the olfactory lobe undulates in response to the sensory input caused by odors. When we zapped the hydrogen waveform with our photon gun, either by pulling the trigger or by feeding in Beethoven's ninth symphony, the undulations of the waveform were retained in the historical record of the textured surface of the Past waveform that was laid down as the hydrogen waveform moved through Time. The waveform of your olfactory lobe is moving through Time in exactly the same way as the hydrogen waveform (except we are not watching it on a computer screen), and as it does so, will lay down a

Past waveform that will have the events of its existence recorded within the texture of its substance.

Thus, as you lean over to smell a ham sandwich, the odor of the mustard and ham will stimulate the endings of your olfactory neurons. Whereas these endings are in your nose, the olfactory neurons are connected to the neurons of the olfactory lobe of your brain, which are thus "observing" these odors. The waveform of your olfactory lobe therefore undulates in response to what you are smelling, and just as the nuances of Beethoven's ninth symphony are recorded in the textured surface of the Past waveform of the hydrogen atom, the waveform of your olfactory lobe will become textured with the nuances of the odors of mustard and ham. Just as with the hydrogen atom, these undulations can be introduced into the waveform of your olfactory lobe only at the Present Moment, and once it has receded into the Past, it will remain as it is forever, because there is no longer any way to put energy into it or take it out.

If the olfactory waveform were on a computer screen where we could see it displayed through Time, we could see the onset of the undulations induced by the odor of the mustard, and perhaps even discern the bumps and knobs associated with the odor of ham. We could think about taking this olfactory waveform and fashioning it into a musical instrument and playing it. If we played it properly, with the proper resonant mouthpiece, we would be able to make the odor of mustard resonate, and we could "remember" the past event the olfactory lobe would "remember" the odor of the mustard.

I have to admit that this is a really unusual idea, in that it says that our brains and memories are something completely different from what we have assumed them to be. The idea says that the brain is not a computer, but a collection of resonators. Remember that our brains are composed

of almost nothing but neurons, and I argued earlier that our neurons are tunable resonators whose role is to make Observations by resonating with the waveforms of objects. Volatile mustard molecules (odors) are objects, and our olfactory neurons Observe them by resonating with their waveforms, therefore intensifying their Reality. The neuron that is resonating with an odor molecule has a waveform that is a sum of the waveforms of the neuron and the odor molecule. Other neurons in the olfactory lobe cooperate in this process, and as they are all Observing the odor molecule, their collective waveforms cause undulations in the waveform of the olfactory lobe to occur.

We should be able to recall this memory with an appropriate resonator, just as we recalled Beethoven's music from within the hydrogen waveform that extended into the Past. What better resonator to achieve this than the olfactory lobe itself? When the olfactory lobe undulated, it produced the textured substance that was recorded in its Past waveform. If you smelled some mustard yesterday, your olfactory lobe undulated accordingly, and laid down a record of the smell of mustard into the waveform of your olfactory lobe. If you smell some mustard today, the waveform of your olfactory lobe will undulate in exactly the same way that it did yesterday, and these new undulations will resonate with the old ones that are recorded in the Past waveform, and you will "recall" the smell of mustard. I would also point out that when you smelled the mustard yesterday, there were all those other input tracks that were recorded in their respective waveforms at the same time, so when you "recall" the smell of mustard, you are also liable to "recall" other circumstances that occurred at the same time, such as what the sandwich looked like (compliments of the visual cortex waveform), where you were at the time (your hippocampus waveform), how you felt about it (your

amygdala waveform), and the philosophical implications of what was happening when you observed the ham sandwich (your cerebral cortex waveform), assuming that the philosophical implications occurred to you. Each of these waveforms was accordingly laid down by a process that involved resonating with the input of the brain neurons, and each of these memories can be recalled by the same resonator that laid the waveform down in the first place.

The rather shocking part of this idea is that it suggests that our memories do not actually exist inside our heads, but are instead stored in waveforms that extend into the Past.

The Past is part of the Dimension of Time, so this implies that our memories actually exist in another Dimension. If this is true, the fact that we access our memories by means of our brains resonating with these Past waveforms means that objects in the Past have a tangible existence, and are not merely ephemeral memories. Since everything we do is influenced by our memories, indeed our very sense of ourselves as individuals is largely a consequence of the memories we have about ourselves (I know I have never committed a murder, and I loved my mother), then the fact that they could be embedded in waveforms that extend out into the Past is a truly transforming idea. It is not an idea that I would want to accept without good reason, because if I were to accept it without reservation, my perspective on the universe would be upended completely.

So the safest thing is to reject it out of hand.

But what if it is true? If it is true, it is vital to know about it, so the remote possibility it could be true demands it be considered further. This is the same argument posed by scientists who wanted to set up a receiver aimed into the cosmos to search for signs of intelligent life. They argued that no matter how you pooh-poohed the idea, if we were

to discover intelligent life, the discovery would completely transform human civilization. This argument has resulted in our setting up a few of these observation stations. This same kind of thinking demands that we consider the implications of the brain acting as a resonator, and the possibility that our memories exist as waveforms that extend into the Dimension of the Past.

The lesson of the Hottentot in front of the Television Set.

While you are thinking about this, I would like to distract you with a story about the Hottentot in front of the television set. A Hottentot, who has spent his entire life living a stone-age-like existence, journeyed into a neighboring village to see what was going on. As he came into the village, he saw a television set, which was completely new to him. As he came up to the television set, he saw a picture of a horse on the screen. He had never seen such a little horse, and was fascinated. He looked closely at the screen, then around the sides of the TV set, and then the back of it. He lifted it up and looked under it. He became frustrated, and raised his stone ax into the air, clearly intending to smash into the TV set and let the horse out. I was watching these events, and I stepped over just in time to restrain him.

"My good fellow," I said. "I need to tell you what it is you are looking at. This is a television set, and it makes pictures out of waveforms that are broadcast through the air. The way it works is that a resonator looks at a horse and converts what it sees into a waveform that is sent out into the air, which travels to this television set. The television set contains a resonator that is tuned very precisely so that it resonates with the broadcast waveform, and no other. If I

press this button on the front of the television set, I can change the resonant frequency of the resonator so that it can pick up a waveform that is broadcast from a different broadcast station."

I proceeded to press the button, and the picture of the horse was replaced by a picture of Niagara Falls. And as we watched, we saw Niagara Falls fade into a picture of the Grand Canyon. I pressed another button to change back to the picture of the horse, and I continued by saying, "Therefore, if you were to break into this television set, you would not find a little horse. All you would find is the electronic components that resonate with the broadcast waveform and convert the information into a picture of the horse."

The Hottentot stared at me in astonishment. He said, "That is absolutely the craziest thing I ever heard. The words you are using, like resonator and waveform and electronic components, mean absolutely nothing to me. The whole idea of what you are saying is ridiculous. The horse I see inside this box is clearly real, it jerks its head and stomps its feet exactly like other real horses I have seen. I just can't seem to get at it, since it is locked up inside this little box. On the other hand, these so-called broadcast waveforms of yours that are flying through the air are completely invisible to my senses. I can't see anything of them, I can't hear anything, and I can't feel anything. I simply don't see how anything that is so completely insubstantial could possibly have sufficient substance to create what is obviously a real horse inside this television set."

With that, he raised his stone ax again, and before I could stop him, he smashed it down through the top of the television set. The CRT imploded, and shards of glass went flying everywhere. Fortunately, neither of us was hurt, and the Hottentot simply stared into the guts of the television set. I had been an amateur radio operator when I was a kid,

so as I stared into it, I could see lots of parts whose roles as resonators and signal processors I could understand. There was the tuning coil over there, attached to the channel selector keypad that was still sticking out of the front of the smashed box. I could see capacitors and resistors, and although I didn't know precisely what any one of them did, I had a general understanding. Over in the far corner was the integrated circuit module that was responsible for extracting and processing the audio signal. I could see a wire coming out of it and going to the bent speaker. I imagined how the module was filled with transistors and other components all arranged on a silicon wafer by means of a sophisticated photographic and electrochemical manufacturing process.

The Hottentot stared in amazement. He said, "Well, you were right about one thing. That little horse is not just sitting in here waiting for me to pick it up. But I saw it just a few seconds ago while I was looking into the box, so it just has to be in here somewhere. Maybe it's just really small, so it doesn't take up much space. Or maybe some kind of sorcery has converted the horse into a form that I cannot recognize. But it just has to be in here, I know it. There is no other place it could be." He stopped for a moment and looked at me, and said, 'And the Niagara Falls and the Grand Canyon are in here, too.' He continued to rummage around, smashing things with his stone ax as he went, looking for signs of the horse, Niagara Falls, and the Grand Canyon.

I left him there, on his knees in front of the television set that was rapidly disintegrating into formless rubble. He continued to rummage around for a while, pulling out all the electronic components and modules, the tuner coil and the audio module, and all the resistors and capacitors. As he pulled them out, he turned them over and over in his

hands, and stared at them very closely. Sometimes he would stare so intently that his eyes would squint, and his brow would furrow. From time to time, he acted as if he saw something that made sense. He would smile, and nod his head a little bit. You could see that he was forming hypotheses in his mind. But these hypotheses were all based on what he already knew and could understand. He knew nothing of resonators and waveforms, so they could not be used in his hypotheses. That would have to wait, until he knew more of the world and its empirical laws. It would help him greatly when he came to know about vibrating strings and tuning forks, and Relativity, and Quantum Mechanics. Until then, he could only rummage.

The lesson of the Brain Scientist in front of the Brain.

I thought about my experience with the Hottentot as I walked past the tree in the quad in front of the hospital, on my way to visit my old friend, Mike MacDonald. Mike was now a successful brain surgeon, who was also well-known for his research on the brain. I had known him for years, and he had taken one of my classes when he was a premed student. We were no longer teacher and student, but friends and colleagues, and we got together from time to time for philosophical discussions. These never really went anywhere, but they were fun. But now, I think I really needed to talk to him. This idea about the brain being a collection of resonators and our memories being waveforms that extend into the Past was beginning to bother me. I needed to talk to someone about it, and Mike seemed to be the perfect person. If it were really the crazy idea it seemed, he would quickly see the flaws in it and set me straight. And once he showed me these flaws, I would be able to forget thinking about it and do things that were more important,

like paying more attention to my kids, and doing a better job of teaching, and doing more research and getting more grants and writing more papers.

So it was with some urgency that I went into the hospital and asked where I could find him. The receptionist at the desk said, "I'm sorry, but Dr. MacDonald is in surgery right now and can't be disturbed. You will just have to wait until he is finished." I paced back and forth in some frustration, and then got an idea. I knew the operating room in which Mike usually performed surgery, so I thought I would just sneak up there and see if he had a slack moment, and we could talk. I waited until the receptionist was distracted by the telephone, and then edged my way toward the far-left corridor, and then to the elevator, and then up to the second floor where Operating Room B was. I remembered it was located near Room 221, which was Dr. Baker's office. I entered the operating room suite, and found a surgeon's gown hanging on a rack. I put it on, mask and everything, and quietly peeked into the operating room itself. There was Mike, seated on a stool beside a patient who was lying on the operating table. But instead of operating on him, Mike was talking to him, like a psychiatrist or something. I listened to their conversation.

Mike was saying, "So your seizures have steadily been getting worse for several years. How are you otherwise? Any memory losses?"

The patient replied, "No, Dr. MacDonald. My memory seems perfect"

"Tell me about what happened to you yesterday," Mike said.

The patient responded, "I was driving in the country, and I felt a seizure might be coming on, so I stopped the car and got out."

"Tell me about what you saw and heard, and anything

else you can remember," Mike said.

The patient closed his eyes and let his mind drift back to the day before, to remember everything as completely as possible.

"I was standing by the roadside, and there was a pasture there, and a horse. The horse was jerking its head and stamping its feet. It whinnied. The afternoon was beautiful. I remember looking around and thinking how absolutely beautiful everything was, and I spent a long time just drinking it in, paying attention to every detail. There were piles of hay in the pasture, which was new-mown. It smelled wonderful, and evoked intense memories of when I was a kid, and took rides into the country with my Dad during the haying season. The sky was an intense blue, and I counted six clouds in the sky, and I noticed how one of them looked like a sheep and another like a snowy mountain top. I remember watching them for a long time as they moved across the sky, and as the sheep-cloud moved along, it slowly transformed into a horse-cloud."

He continued. "While this was happening, I smelled the honeysuckle and the clover. I heard a lark sing, and I turned to look at a grove of trees standing by the pasture. There were four trees standing by a pond. One of the trees was a lovely weeping willow, its branches dipping down to touch the water. There were some ducks on the pond, and I could hear them quack. A fish jumped, and I heard the splash. Another tree was an oak, and I could see its acorns scattered around the ground. I looked back at the horse, and it had moved off to another part of the pasture. It turned to look at me. It jerked its head again, and whinnied"

He stopped talking for a few moments, his eyes still closed. "Doctor, it seems so real as I am remembering this. Although I know it is just a memory, it seems as if I am actually there. I can see the horse in my mind and hear its

whinnies. I can smell the new-mown hay and the clover. But unlike the actual experience, I can review it in my mind, not just run through it like a movie. Any time I want, I can start all over again just by thinking about stopping my car to get out. Or I can start in the middle by thinking about the horse. Or start near the end by thinking about the ducks, or the horse that has moved to a different place in the pasture."

He stopped again, took a deep breath, and swallowed hard. "Doctor, I hope the operation you are going to do to help my seizures does not harm my memory. At this moment, because of my remembering yesterday afternoon in the pasture, I realize how precious my memories are. They are what make me what I am. If I were to lose the ability to form and recall memories, I think I would cease to be myself, or even a person."

Mike reached out and squeezed his arm. "Don't worry," he said. "This type of operation has been done quite a few times, and it seems to have little effect on memories."

With that he gave him an injection, and the patient closed his eyes and proceeded to fall into a deep sleep. Mike waited for a few moments, and then turned around on his stool to a nearby table that was covered with operating instruments. He selected a saw and a scalpel, and turned back toward the sleeping patient. He raised the saw and held it deftly over the forehead of the patient, and lowered it until it rested lightly against the relaxed furrows of his brow.

Without realizing what I was doing, as if I were replaying an incident from my Past, I stepped over to restrain him. "My good fellow," I said. "I need to tell you what it is you are looking at"

Mike was startled by my intrusion, and turned away from his patient, and toward me. I pulled my mask down

so he could see my face.

"What on earth are you doing in here," he said sternly. "People don't just wander into operating rooms when brain surgery is under way."

"I just had to talk to you; I said a little lamely. "I have a problem that is bothering me a lot, and you are the only one I know who can help me"

With this, his sternness relaxed and his expression changed to concern. He turned on his stool to face squarely in my direction.

"Well, O .K. This fellow has just gone under and will stay that way for a long time. I wasn't going to start now anyway. I was just holding my saw over his forehead to check to make sure I had a saw that was the right size. When we really get going, there will be a crowd of people in here. So what's up?"

Mike seemed surprisingly relaxed and receptive considering the circumstances, so I decided to approach my problem slowly. So I said, "I couldn't help but overhear your interview with your patient, and his telling about his memories of the horse in the pasture."

"Yes, that was interesting," Mike said. "He was unusually detailed in describing his experiences. But I think the experience was unusually intense for him because he was worried about the operation he would be having today. I think we all have the ability to do this, it's just that we are usually assaulted by so much sensory input that we don't bother to keep track of it all:"

This was related to why I was there, so I said, "Before I came over here this afternoon, I was making some copies of some lab photos with my computer. They were color photos, so I scanned them into my computer with my color scanner:" Mike did not seem to be impatient with this, so I continued. 'After I scanned them in, I checked to see how

big the files were, and they were absolutely huge. In fact, when I scanned one color photo using a resolution of 1200 dots per inch, the file was almost 80 Megabytes. I was astonished how much memory one photo could take. It was a big chunk of my new Gigabyte hard drive, which I had thought was a bottomless pit when I bought it. It's not so big after all. Hold maybe ten color photos, max."

Mike knew more about computers than I will ever know, and he said, "So, what's your point?"

"Well," I said. "I was thinking about how much memory space one little color photo takes up, and as I was listening to your patient relate the experiences of his afternoon, I began to wonder where all those memories were going, and how much storage space they would have to take up. The eye has at least ten-fold better resolution than my color scanner, so if I were to scan a photo with a scanner that is comparable to the resolution of the eye, I wouldn't be able to get even one photo onto my Gigabyte drive, since a ten-fold increase in resolution translates into a hundred-fold increase in storage space. Just the one photo could fill up maybe eight or ten Gigabyte drives. And that is just one little photo that fits on my scanner. This guy was out standing in a pasture that extends in every direction as far as the eye can see. And he didn't take just one photo of it, but a continuous series of photos. This is shown by how he could describe the sheep-cloud slowly transmogrify into a horse-cloud. This slow shift would correspond to hundreds and hundreds of photos. He was standing in that pasture for maybe an hour or more. The way he was going, if he wanted to, he could probably have described the whole of it to you in incredible detail, from the moment he felt a seizure coming on to when he got back into the car. And not only pictures. He has all the other senses that were also pouring in information that had to go someplace. His sense

of the smell of new-mown hay and the clover were particularly intense. And there were the whinnies and the ducks quacking. The amount of information that was taken in during that afternoon and stored away is absolutely staggering. It is almost beyond computation. If it were all going onto hard drives, there would be so many that they would fill up the Grand Canyon. And this is only a small part of a single afternoon of this guy's entire life, every hour of which has produced a similar mountain of information that has been stored somewhere. Experience tells us that once we have experienced something, the memory of it remains always. Sometimes we can't recall it, but it is there, as is shown by hypnosis."

Mike raised his hand as if to protect himself from my outburst. "O.K., I get your drift."

"Yes, I agree that it is amazing, and I have thought about it quite a lot," he said.

"First of all," he continued, "you need to know that the brain is an incredibly complex organ and is undoubtedly the most complex thing in the known universe. So how it goes about doing things is surely complex and marvelous. First, you have to start with the fact that the memories are there. Since the memories are there, they have to be physically be someplace. Experiences are taken in thorough our senses, and they are converted into memories. And these memories are stored, until we recall them. You mentioned the hard drive of a computer, and that is probably not too bad of an analogy, but probably oversimplified. When you feed information into a computer, say through your scanner, a program processes it into digital form, and these digits are stored on the hard drive, or perhaps retained in RAM in the form of a complex pattern of charges within the memory chips. If you were to pry open these RAM memory chips, you would not find the scanned

photograph, but only a pattern of charges. Unless you knew the rules of how the information in these charges could be converted back into a photo, it would be absolutely meaningless to you."

This line of thinking continued to be favorable to my purpose, so I asked Mike, "So what about the amount of space that the memories can take up?"

Mike said, "Well, that is probably not as big a difficulty as it seems. We are just now beginning to explore the possibilities of data compression with computers. Right now, it is possible for a compression program to take the data on your hard drive and compress it into a space that is maybe one-tenth of what it now occupies. Much better compressions can be done if you go about it in the right way. One can think of it as a process of miniaturization, in which you take a thing that is originally large and just make it very small so it takes up little space. In this way, we can see how an afternoon in the pasture does not take up a Grand Canyon's worth of space, but merely a negligible corner of the brain. This leaves plenty of room for all the other experiences that occur during a lifetime. Of course, if we go into the brain, we cannot expect to find these memories, because they will be changed into a form that we cannot recognize, and they will be incredibly miniaturized. I know that this is amazing, but there is simply no other way to explain it. After all, there is the indisputable fact that the memories are there, and this demands that they have been put someplace. It's pretty obvious that miniaturization of the pile of data and converting the data into something we would not recognize are what the brain does. What other explanation could there possibly be?"

Mike looked at me expectantly, as if maybe I had been leading to some interesting philosophical discussion. It was certainly the perfect opening to saying something like,

"Well, I have this idea about the brain being a resonator that recalls memories by resonating with waveforms that exist in the Past" But I couldn't bring myself to say it. Mike was a friend, but this idea was too radical to suddenly toss onto the table. I decided to continue to beat around the bush with questions about the brain, which he loved to talk about. So I said, "Remind me about what is known about memories and how they are formed and stored!"

Mike brightened at this because it was getting into his special interests, and said, "That's a tall order. There has been so much great work done over the last thirty years or so that are providing marvelous insights. As I said, the brain is just so incredibly complex and we have absolutely no idea about how it actually works. It is clearly a computer, but a marvelous one that processes data in a highly parallel fashion. That is what makes it possible to walk and chew gum at the same time." I knew he expected me to laugh a little at this, so I did.

He continued. "There is some really good stuff about memories. Goldfish can't learn if you inject their brains with an inhibitor of protein synthesis, so the formation of memories is clearly a process that requires protein biosynthesis. This implies that proteins are somehow wrapped up in memory storage, although no one has found proteins that actually contain specific memories. We have also discovered that conversion of an experience into a memory that we can recall later requires that the hippocampus, which is a lobe of the brain, be intact. People who have lost their hippocampus through surgery or injury are totally incapable of forming permanent memories. If you walk into a room to see someone who has lost their hippocampus, introduce yourself and sit down to have a conversation with them, they will respond in a reasonably normal way. If you excuse yourself and come back twenty minutes later,

you have to introduce yourself all over again. Interestingly though, you can teach these people how to put a puzzle together; and later they will be still be able to put it together while being astonished that they can do it. So there are clearly different kinds of memory, and the hippocampus is necessary for only some of them. Memories are compartmentalized and categorized, and there are people who can recognize categories of things, but not members of a category. Whereas they can identify a thing as a plant, or an animal, or an automobile, or a person; they cannot manage to identify a particular plant as a dandelion, or a particular animal as a cat, or a particular car as a Chevrolet, or a particular person as cousin Mary."

"What is known about the physical form of memories?" I asked innocently.

Mike's face darkened a bit. "We have not gotten as far on that as you might suppose. But remember, the brain is complex and unfathomable, so we don't know exactly what we are looking for. DNA is a good lesson here. Ever since Mendel and Darwin, it was pretty certain that the genetic information of an organism was somehow stored in its biological molecules. The question was, which biological molecules contained it? By the turn of the century, biochemists had learned about nucleic acids, proteins, carbohydrates and fats. These were scrutinized one by one for having the kinds of properties that they expected the genetic material to have. They rejected DNA very early on, because it was too simple, and composed of too few components. The only differences they could see within different parts of DNA were the four different bases: G, A, T, C. There was just not sufficient complexity there to be a container for what obviously had to be incredibly complex. They were embarrassed when they finally got around to discovering that the four bases were like letters, and these letters spelled the

sequences of proteins. Now that we have learned this lesson, we are not about to forget it. The memory storage molecule is probably even more elusive. It is probably something that appears very simple, but somehow you can write the experiences of a lifetime on it."

He stopped, took a breath, and continued. "Many of us believe that our memories are somehow stored in our neurons. One reason for this is that the brain is essentially nothing but neurons, except for the glial cells which provide scaffolding for the neurons. In humans, brain neurons are incredibly interconnected. A single brain neuron might have as many as ten thousand dendrites, all of which provide information inputs to the neuron. These reach out to perhaps ten thousand other neurons, and since the brain has hundreds of billions of neurons, the number of connections and pathways borders on the infinite. Each of these neurons has a membrane, and the membrane is covered with charges. The situation is reminiscent of what you see in a computer, with a memory array that can take on different charges, and the elements of the array are interconnected. We see how this kind of arrangement works to store memories in a computer. It's a pretty good bet that the brain works the same way. The Artificial Intelligence people have seized on this idea to construct 'Neural Networks, which consist of an array of interconnected analog devices that can have a variable output that can feed into many other similar devices in the network. The nice thing about this arrangement is that the network can 'learn to do things by 'experience' rather than being explicitly programmed like a normal computer. They envision this learning process to be quite like the one that goes on in our brains, except that instead of a few hundred interconnected devices, our brains have billions of interconnected devices. Hence our powers of learning and thinking are enormous

in comparison to the artificial Neural Network model."

This was starting to move in a direction that was not completely helpful to my purpose, so I changed the subject a little. 'Are there any experiments that show us how we form memories?'

"Yes," he responded quickly. "There is a technique called positron emission tomography, or PET, in which you give a subject some radioactive glucose that gives off positrons, which can be detected by an instrument. Subjects are then given mental tasks to do, and experimenters can tell which part of the brain is 'working; because that is the part where the glucose positron emissions are most abundant. If you show the subject a picture of a horse, the visual cortex will show activity, which is not surprising, since it has to do some work to process the information and this requires metabolic energy, which the glucose provides. One of the most interesting experiments is one where you show the subject a cube, whereupon the PET shows that metabolic activity occurs in a certain part of the brain. Then you ask the subject to remember what the cube looked like, and as the subject remembers the cube, you see activity in the same part of the brain as when the subject looked at the cube. This shows us the processes of formation and recovery of a particular memory tend to occur in the same part of the brain, perhaps even involve the same structures of the brain. But this is not always the case. For example, when you think of a certain sound, one part of the brain will be activated, and when you hear the sound, another part of the brain may be activated. Similarly, the thinking of a word, saying the word, and hearing the word, may involve three distinct areas of the brain. The problem with these experiments is that while they show what parts of the brain are being utilized to form and recall memories, they do not show what the brain is doing when it does

these things. All we know for sure is that both the memorization process and the recollection process require metabolic energy, and it is the glucose that is the source of this energy. It doesn't tell, of course, what biological molecules are being synthesized or modified during the process of memorization, but the experiments with protein synthesis inhibitors it prove to us that the processes of synthesis and/or modification are clearly going on. Particularly relevant is that we can see that parts of the brain that are utilized increase the number of synaptic connections that they possess, which suggests that the memories are somehow stored within the pattern of synaptic connections. This provides an increasingly strong foundation for the theories of memory that have been in place for decades."

"I may have missed it, but did you mention the locations where specific memories are actually stored?" I asked innocently.

"No, I didn't mention it, but that is a very interesting thing," Mike answered. 'Although they are clearly stored within the patterns of synaptic connections, specific memories do not seem to be stored in specific locations, but are somehow distributed throughout the brain. This is analogous to a hologram, each part of which contains the whole image, but at low resolution. You can cut a corner off a hologram, and the image that you can reconstruct from the remaining hologram is completely intact, but just not quite as well-resolved, or a little bit fuzzy. Similarly, when you remove a piece of the brain, you do not just cut out some set of memories, like what would happen if you removed a section of your computer's hard drive, which would destroy a discrete set of stored data. Memories are definitely not like that, and a particular memory is not in a particular location, but smeared out all over your brain. This, in fact, is one of the pieces of evidence that has led to the

idea of Neural Networks, and that memories are stored in the interconnections of neurons. You can remove sections of a Neural Network and its performance will degrade somewhat, but not just cease. Similarly, you can remove some neurons from your brain, and a particular memory will not be destroyed, but just get a little 'fuzzy.'

"That's fascinating," I said noncommittally. "So tell me, what's wrong with your patient?"

Mike reacted with startled surprise, and glanced hastily down at his sleeping subject.

"Oh," he paused. "He's an epileptic. You know, the disease where one has seizures and falls down and starts to shake all over. They used to put epileptics in prisons or mental hospitals in order to restrain them, although mentally they are perfectly fine. As you could see from our conversation, this guy is sharp as a tack. I want to do whatever I can to help him. His seizures have been getting worse and more frequent, and the anti-seizure drugs that he has been taking are not working very well anymore."

"What is the underlying cause of epilepsy?" I asked.

"We don't really know for sure," Mike answered. "But it's as if there is some kind of 'electrical storm' that goes off inside the brain, and when it does, a seizure occurs. Seizures are often precipitated by lights that blink on and off at certain intervals, as if the electrical storm is some kind of oscillation that gets out of control. The victim typically has no memory of the event."

"How is it treated?" I asked.

"Usually with drugs," Mike answered. "But in serious cases, like this one, the drugs aren't enough. The only cure that works pretty consistently is brain surgery, particularly brain surgery in which the Corpus Callosum is severed."

I had heard of this operation, and especially its consequences, or lack of them. The Corpus Callosum is a thick

bundle of neuronal fibers that interconnects the two halves of the brain. There are more than 200 million fibers in it, and one would think that they are very important. If you were to dig down under the streets of New York City and find a bundle of 200 million telephone wires that connected the upper end of the city to the lower end of the city, you would assume that they were important. You would expect that if you were to cut this bundle of telephone wires that the city would grind to a halt, and you would be right. But, amazingly, a surgeon can sever the entire bundle of fibers in the Corpus Callosum and virtually no effect on the patient is observed. Whereas one would expect that it would be vital that such a massive bundle of nerve fibers remain intact, but no.

However, it was eventually discovered that such individuals were not completely normal, but that the two separate halves of the brain now existed as two separate entities. Not completely separate entities, since the brain was not severed completely into two halves, but just at its top, so there were still interconnections at the Y, below. Nevertheless, studies of these "split brain" individuals showed that the brain specializes in its functions, with language and perhaps logical reasoning functions being performed mainly by the left side of the brain, and non-verbal and creative functions by the right side of the brain. This is what gave rise to the expression "He is a right-brained person," meaning, he is guided mainly by emotion; or "She is a left-brained person," meaning, she is guided mainly by reason.

Virtually the only individuals who have ever had their brains divided in this way have been severe epileptics, and the reason that the operation was done was to try to control their seizures. Although the reason it works is not exactly known, it is assumed to somehow dampen those

'electrical storms; and a person who has had the operation can look at rhythmically blinking lights and not experience a seizure.

"I have heard about this operation," I said.

"I'm sure you have," Mike answered. "The split-brain phenomenon borders on the metaphysical. Some people claim that the Soul has been cut into two separate parts, and that two distinct personalities are now occupying the same brain. The two halves of the brain can have different emotional responses to situations, and have different outlooks on life, and different talents. Others say this is a lot of hogwash."

Mike looked at me again, expectantly. "So what is your problem, anyway? It had better be pretty important, because as you see, I am professionally involved at the moment," he said as he gestured toward the sleeping figure on the operating table. I decided it was now or never. I cleared my throat.

"I have this idea, and I am sure it will seem like a crazy idea. When I first thought of it, it seemed like a crazy idea to me too. But I have thought a lot about it, and I just can't convince myself that it is absolutely impossible. And if it is not absolutely impossible, and even a little bit possible, I thought it was important to spend some time thinking it through. Maybe even take it seriously. But I found that even pretending to take it seriously, just in order to think out its ramifications, made me feel like I was going crazy. So I decided to come over here. Just to bounce it off you. To see if you think it is really crazy. Which I'm sure you will. But then, what I really want, is for you to explain to me why it is crazy. With good, sound arguments. When you do that, I think I can just forget about it and do other things that are more important."

"Throw it at me," said Mike. "I'm waiting."

This was it. I took a deep breath and said, "My idea centers around observations and waves. It has led me to think that neurons are cells that are highly specialized for the purpose of making observations, and when they make observations, they provide resonant energy to what they are observing. When they resonate, the waveforms of the neurons merge with the waveform of what is being observed, and the metabolic energy of the neurons intensifies the Reality of what is being observed. Since the brain is mainly a collection of neurons, this means that the brain itself is a resonator that is divided up into separate resonators. These separate resonators are what we know as the different lobes of the brain; the visual cortex, the olfactory lobe, the cerebral cortex, and so on. When the neurons in these different lobes make observations, such as when the olfactory neurons smell a smell, the waveform of the olfactory lobe is altered in response to the observations. This means that the waveform of the olfactory lobe undergoes modulations through Time, and as the Present-Moment waveform recedes into the Past, it remains there forever since it is deprived of access to energy, either to absorb it or emit it. The Past waveform of our entire brain is therefore composed of a series of recorded tracks, each one laid down by the lobe of the brain that is devoted to a particular sense or type of experience. The Past waveform of our brain therefore contains a permanent record of our life's experience as interpreted by our senses. The resonators that laid this waveform down are ideally suited to play them back, and do so by a process of recall that also involves resonance. Since the resonators that created the waveform exist in the Present Moment, they have access to metabolic energy, which is crucial for providing the energy required to provoke the resonant response. This metabolic energy provided by the neurons does two separate things. One is

that it is used to create the Past waveform of the brain, which constitutes our memories. The other is that the energy enables the brain to resonate with this Past waveform to recall the memories that are stored in it."

Mike sat there and just stared at me.

Finally, he said "That is absolutely the craziest thing I ever heard. The words you are using, like resonator and waveform make perfect sense, but the context in which you are using them means absolutely nothing to me. The whole idea of what you are saying is absolutely ridiculous, and there's not a shred of scientific evidence to back it up. The memories inside our heads are clearly real, and just because we can't get at them because they are compressed and altered so they can be stored does not in any way change the fact that they simply have to be in there. These 'Past waveforms' of yours. Why can't I see them? If they are there, *why* are they completely invisible to my senses? I can't see anything of them, I can't hear anything, and I can't feel anything. I just don't see how anything so completely insubstantial could possibly have sufficient substance to create what are obviously real memories inside our brains."

I realized that I had heard this argument before, in another place and at another time. But the circumstances were different. When I was talking to the Hottentot about resonators in the television set and waveforms from the broadcast station, I knew that I had the entire edifice of twentieth century science to back me up. I could speak with sureness and authority. But here, talking to Mike about resonators in the brain and waveforms of the brain extending into the Past, I felt like one Hottentot talking to another Hottentot. I had no authority other than the results of some philosophical musings about the relationships between Observations and Reality. Although when I origi-

nally went through the ideas it seemed as if I had been using a process of step-by-step logic, it suddenly seemed completely insubstantial, like a house of cards built with each card precariously balanced on the one that had been placed before it. The merest gust of air would blow it down. And Mike was a hurricane. Then I realized that this was exactly what I wanted. If I had built a house of cards, I didn't want anything to do with it, and the sooner it gets flattened, the better.

"I told you that you would think it was ridiculous. But what I really need is for you to tell me why it is ridiculous."

Mike leaned back and laughed. Then he settled onto his stool and looked directly at me. His eyes narrowed, and he recovered his stern look.

"There are so many things wrong with it, that I hardly know where to begin." He waved his hands and glanced at various corners of the room as if he was doing a random mental search.

"First of all, there's Occam's razor. Whenever you formulate a hypothesis, you should always go for the simplest one possible, and avoid unnecessary complications. Even if what you are hypothesizing is really complex, it is best to start simple and slowly work toward complexity. You don't just start out with a hopelessly complex hypothesis. It's sure to be wrong, and will just lead you in wrong directions. I can see what you have done. You were sitting there in your office watching your computer scanner scan that photograph. You looked at the size of the file that it made and said, "Ohmigod." Then you ran your eyes along the bookshelves and out the window, and thought about how much memory storage in your brain was being sopped up by all the images you were looking at, and you decided that your brain wasn't big enough to hold it all. You started casting about for explanations, and none came to mind, so you

started thinking really far out. Bingo, waveforms extending out into the Past and resonators to put them there. Just because you thought of it doesn't make it true."

Mike was on a roll now. "What you really need to learn to do when you think out a hypothesis is to impose constraints. You need to constrain yourself to consider only those things that are directly relevant. When you are thinking about the brain and what memories are, you need to focus on what the brain is made of, and this constrains you to what is possible. The brain is a living tissue, and like all living tissues it is composed of macromolecules like DNA, RNA, protein, carbohydrates, and lipids. And tens of thousands of little molecules that are mainly the reactions and products of metabolic pathways. If you want to know what memories are, you must constrain yourself to considering these components and these components only, because since that is what is there, and because that is all that is there, they are what memories have to be made of. You have been led astray because you have allowed yourself to consider absolutely anything your mind can conceive of. With this kind of flabby thinking, no wonder you are in here with this cockamamie idea about Past waveforms and resonators. You've staggered into the labyrinth and you don't have a string to lead you back out. Unless you have some kind of compass to guide you, you will never be able to find your way."

"Actually" I said, "I do have a compass. It is that everything is observations and waveforms. It is based on the idea that if you can't observe something it doesn't exist."

Mike rolled his eyes toward the ceiling. "I don't believe it," he said. "It's the old 'Does the tree that falls in the forest make a sound?' nonsense. I first ran into that when I was about five years old. My big brother said, 'Tell me, if a tree falls in a forest and there is no one to hear it,

does it make a sound?' I thought about it a few seconds and said, 'Sure: Then he said, 'Think again. A sound is something you hear, and if you are not there to hear it, then the sound is not a sound: I wandered off, and then spent most of the afternoon thinking about it, and kept going back and forth. Yes it was a sound, no it wasn't a sound. It all seemed to depend on exactly what a sound was. If you defined it as one thing, such as a sound consists of vibrations in the air, then it was a sound. But if you defined a sound as the thing that the mind became aware of as a consequence of the vibrations in the air, then unless there was someone there to interpret the air vibrations as a sound, then it wasn't a sound.'

Mike stopped and looked thoughtful. "You know, I hadn't realized it until this moment, but it was that afternoon that I spent thinking about the relationship between sounds and the mind that set me in the direction of becoming a brain scientist. But I was always impatient with the 'tree falls in the forest' stuff after that. It was obviously leading nowhere. When I got to college, I took a modern philosophy course. Modern, 'ha: Started with Descartes back in the seventeenth century. 'I think therefore I am.' Nothing useful there. Then there was George Berkeley. He thought that maybe nothing existed unless you observed it. People took him seriously for a while until someone pointed out that the tree in the quad must disappear when you're not looking at it. Or when you close your sock drawer, the socks disappear. Snatch' it open, and There They Are Again! It wasn't long before people were absolutely rolling in the aisles laughing about it. Berkeley got a little defensive and suggested that maybe when we weren't looking at things, God was looking at them for us. By this time, people were laughing so hard that they couldn't laugh any harder, so they just got up and went away."

Mike shook his head. "You know, I can't believe that someone like you would get mixed up in this crazy stuff. Don't you have enough real work to do?"

"Well," I said defensively, "I wasn't really working at it, at least not at first. It started out just as a kind of mental recreation, just something to do when I was stuck somewhere with nothing better to do. Like driving the car, or waiting in an airport, or sitting in a boring seminar. It was always there and convenient. And cheap. I didn't have to get up and look for a newspaper or magazine, or pay any money. I could just sit there and think about the implications of 'that which cannot be observed does not exist: It really got into some interesting stuff. Like it explains what gravity is, and inertia and momentum." I think I produced a lame expression as I said this.

"Gravity, huh," Mike snorted. "I'd really like to see that one. It beats me how you could get to gravity from a flimsy idea like something doesn't exist unless you observe it."

"That's not exactly what I said," I said. "I said, 'that which cannot be observed does not exist; which is really quite different from, 'something doesn't exist unless you observe it.' "

"Maybe you see a big difference, but I don't," said Mike. "It's pretty much the same dumb idea, just with the words mixed up a little bit. But what do you mean, it explains inertia and momentum? We already know all about those. Haven't you ever heard of Newton's Laws of Motion? Inertia and momentum are all laid out right there"

So here was something Mike did not know! I explained eagerly, "I thought we understood them too, until I read one of Richard Feynman's books. You know, the Nobel Prize-winning physicist. He was always going around telling people what physicists don't understand.

Without him, people like us would think that physicists know and understand everything, at least to hear them talk. It's behind closed doors that they bang their fists on the table and the tears of frustration flow at their inability to understand gravity or Quantum Mechanics or even things as simple as inertia and momentum. And the idea that everything is observations and waveforms explains all these things, and the fact that it explains all these things argues that it is correct."

"Don't you wish," said Mike. "I should probably take you by the hand and walk along the logical path that you took in coming up with these crazy explanations. It would take about ten seconds to trip over a logical flaw. Look what Descartes did. He wanted to prove the existence of God through philosophical argument. He started with 'I think, therefore I am! Then he was stuck. He stumbled around for a while, and then decided that one of the basic assumptions he needed to make is that there is a God. Having made this assumption, he went on to prove that God exists. Not real impressive. You obviously took about two steps down the logical path, and then took a sharp turn into La-La land. Now that you are there, everything is just La-La fine. No wonder you can explain everything. If you don't have any rigor in your logic, everything is worthless. Without rigor, it's like a rubber sheet that you can stretch in any direction to fit anything. That is obviously what you have done."

I had to admit that I was afraid I had done exactly that. Then I reminded myself that the reason I was here was to discover whether that was the case, and if it was, to abandon the whole idea.

So I said, "Look, Mike. I agree with everything that you are saying, and most particularly that I have probably come up with these ideas through faulty reasoning. But I am not here to defend either the reasoning or the ideas. In fact, I am

here to do exactly the opposite. I want to attack them as hard as I can. I want to tear them down with every tool I can come up with. Every counter-idea, every counter-argument. The thing that I most want are some facts, maybe some experimental observations that are completely inconsistent with these ideas. If they are truly crazy ideas, it should be duck soup to come up with inconsistencies that make the ideas untenable. Then I can forget about the ideas. If you think the moon is green cheese, send an astronaut to pick up a piece of the moon. Barn, the moon as green cheese is no longer a viable idea, and you can forget about it. That's what I want."

"Sounds good to me. Should be pretty easy" said Mike. "Where should we start?"

"Why don't we start right here, with your epileptic patient," I suggested.

Mike again seemed a little startled when he was reminded of the prone figure beside us. He looked at his watch. Then he shrugged his shoulders and turned his attention back toward me. "Okay, let's start there;" he said.

I said, "How about his detailed memory as a starting place? My idea says that the memories of his afternoon with the horse in the pasture, and the clouds moving across the sky, and all the other experiences are stored in waveforms that exist in his Past. They are exquisitely detailed memories that are perfectly stored because the Past waveform is, for all practical purposes, his actual experiences as interpreted through his senses. His recall of these experiences is through a process of resonance, in which the lobe of the brain that produced a particular component of the memory waveform is responsible for resonating with the Past waveform to recall the memory. Because this waveform extends back through Time, the fact that there is a prodigious amount of information that needs to be stored

somewhere is not a problem. The brain no more fills up with memories than a television set fills up with the horses and scenic vistas that it received as broadcasts."

"It's not fair to start there," said Mike. "Because this whole idea was your attempt to come up with an explanation for where memories are stored. You could have said that they are stored as lumps of green cheese on the back of the moon and just as easily solved the storage problem."

"That's not true," I responded. "I came up with the Past waveform idea by thinking about violin strings, and tuning forks, and Observations, and the waveform of a hydrogen atom. The fact that it lead to a solution to the memory problem just happened, just like explanations of gravity, inertia and momentum just happened. I had not been working toward them in any way, and was surprised when they emerged."

"Oh," said Mike. "Well, I guess you are lucky on this one. We'll just have to move on to something else in order to trip you up."

"Mike, I don't think you understand. I WANT you to trip me up. I am EXPECTING you to trip me up. So let's get on to something else."

"Well, let me see," he mused. "How about epilepsy, and its symptoms, and its 'cure: "

Mike said "cure" a little ruefully, since it involved slicing brains in half. Mike went on. "Epileptic seizures are precipitated by things like lights blinking in a certain rhythm, which seems to set up some kind of abnormal oscillation in the brain."

Mike seemed surprised to hear himself say this.

"Funny, the phenomenon of epilepsy seems to fit with your waveform and resonator idea pretty well. If the brain is a bunch of resonators that generate waveforms, it could be that epilepsy is some kind of structural flaw that gener-

aces some kind of harmonic that sets off a seizure. This harmonic would affect the entire brain, since it is a collection of resonators. One could think of the brain like a gong made of metal, say, and the gong is in the shape of a ring. If you hit the gong, it will resonate and give off a tone that consists of the fundamental resonant frequency and its harmonics. When we treat epilepsy by severing the Corpus Callosum, we are cutting through the ring at one point. Since it is a ring, it doesn't fall apart. If you cut a metal ring gong in this way, it will not have a very great effect on its ability to vibrate and resonate. If you hit it, it will give off a sound that is pretty similar to the original one, except maybe the fundamental will be gone. But most of the harmonics will remain. The biggest effect would be caused if the ring is not completely homogeneous throughout, but varying in thickness and composition. When you cut through the ring, and if the thickness and composition of the ring on the two sides of the cut were different, then the parts of the ring on the two sides of the cut would resonate differently. Although the ring as a whole would resonate as a unit, if you were to look very closely at the part of the ring on one side of the cut and watch it vibrate, and then compare it to how the other side vibrates, the fact that they are different would prevent them from vibrating in a perfect mirror-like fashion. One might say that the ring has now acquired aspects of two 'personalities' whereas the original ring had only one. This would explain why cutting through the mass of neuronal fibers of the Corpus Callosum does not have a very big effect on the brain, except for dividing the two halves into two separate 'personalities'. The two sides of the brain are different, so their separation would allow them to resonate with their experiences differently just as the parts of the metal ring that are adjacent to the cut resonate differently from each other after the ring is cut. It

also says that the brain has the shape it has because of its need to act as a resonator, and that the cerebral cortex and all other parts of the brain are resonators. That's why you can divide them without destroying their function, because dividing them has no more effect on their resonance characteristics than dividing a metal ring gong will affect its resonance characteristics. If epilepsy is caused by an aberrant harmonic, perhaps it is stilled by cutting through the Corpus Callosum. But not necessarily always. It explains why the operation can cure epilepsy, and also explains why it sometimes fails. And it also is completely consistent with the bizarre after-effects of the surgery, such as why there is little all-over effect, except that the brain is divided into two personalities."

I was shocked by what Mike was saying. It was as if he had become trapped in a resonant pathway I had experienced this. You get an idea, and then it begins to resonate with you. It flows forward, looking for a path of least resistance like a puddle of water creeping across the floor. Before long, you find that you are flowing from one part of the idea to the next, and once you are in this pathway it is hard to get out of it, just like bobsledders who put their bobsled into a bobsled run. The sled goes careening down the run, and seems to be totally out of control. But the general path of the bobsled is maintained by the high walls of the run, and the bobsled goes back and forth, oscillating around the valley between the sides. Once you are in this run and are under way, about all you can do is hold on and ride. And Mike was riding.

Mike shook his head and looked up, a little dazed. Maybe even a little shaken.

"This is not going as easily as I expected," he said as he took a deep breath.

He thought a bit. And then he said, "The best

approach to demolish a hypothesis is to take some truly bizarre off-the-wall experimental observations, and see if the hypothesis can explain them. The more bizarre, the better. So bizarre that no one has been able to come up with an explanation that can include them. As long as your hypothesis has not been specifically tailored to explain these bizarre things, then if it can explain them, it is a very strong argument in favor of the hypothesis. Most importantly, if the hypothesis is incorrect, it will almost invariably go down in flames. So what we need to do is think up some bizarre experimental observations with respect to the brain."

I sat down on a stool near Mike and rocked back and forth, thinking. "I've been reading lately about some experiments with brain damage," I said. "Some of them give really weird results.

"Such as?" Mike said.

"Well," I said. "One that comes to mind are some experiments with a patient who had part of his visual cortex destroyed, but there was nothing wrong with his eyes. If you held an object in the left part of his visual field he could see it perfectly, but if you held it in the right part of his visual field, he could not perceive it. The interesting thing about this, is that his memories became impaired in a similar way. He was asked to remember a visit to Milan, Italy. He had visited the square to see the cathedral. He was asked to remember standing in front of the cathedral, and describe what he saw. He described only things on his left, but not on his right. He was then asked to imagine turning away from the cathedral and face in the opposite direction, with the cathedral behind. While he was imagining the cathedral behind him, he was again asked to describe what he was imagining. Now he described things that were on the right of the cathedral, but not on the left. The researchers who did this exper-

iment were pretty much at a loss to explain it."

As I finished with this description, I found that Mike was looking at me through narrowed eyes.

"I see what you are doing, you are setting me up," he said. "You are now expecting me to say, Wow, that fits with your idea perfectly. When you destroy part of the visual cortex, you are destroying its ability to resonate. Since it is resonance that is involved both in creating the Past waveform, as well as recalling the memory from the Past waveform, then destruction of a part of the visual cortex will make it unable to resonate in response to visual input from the retina, and it will also be unable to resonate in order to recall memories from the Past waveform. Even though the memory of the cathedral was formed when the resonator was intact, the portions of the scene that were recorded by the part of the resonator that was destroyed cannot be recalled because that resonator is no longer available. When the subject turned around and imagined what was behind, the part of the brain that successfully imagined what was there was the part that could still resonate. The part that could no longer resonate was silent. Well, I am not going to fall for that."

"No, Mike, really. I did not set you up. I just thought of that experiment without really thinking it out. The fact that it fits my hypothesis is just an accident, not a plan."

"Yeah, right," said Mike. "But it does set me to thinking."

I suspected that Mike was about to step into another resonant pathway. This was not going well. I was beginning to fear that when I left here, it would not be with a light heart; and that the weight of my compass would still be on me.

Mike continued. "I have always been fascinated that someone like Beethoven could write all that great music,

like his ninth symphony, while he was completely deaf. He wasn't deaf because of brain damage, but apparently because the ligaments of his inner-ear bones got stiff. He was deprived of sensory input into the hearing lobe of his brain, but the lobe itself was intact. People who have gone deaf this way claim to be able to remember what it was like to hear sounds, and what the sounds sounded like when they heard them. Blind people who have lost their sight because of eye damage also can remember what it was like to see, and the things that they saw, and even imagine what things they had never seen might look like. If the various parts of the brain act as resonators, then people who are blind because of brain damage would not be able to remember things they had seen before the brain damage, or imagine what something would look like. And deaf people with damage to their hearing lobe would not be able to remember sounds or imagine them. But Beethoven could compose music, even play it in his head, because all of his brain resonators were completely intact. And since he had been intensely involved with music for his entire life before he became deaf, he had many Past waveforms with musical memories in them, and experience with many resonant pathways that he could follow in his thinking about music. As he thought about this music, he could generate new music because he could exert 0-forces that would allow him to switch through an intricate series of resonant path-ways, just like someone who is donning a pair of gloves"

Now I became alarmed. I had never mentioned anything to Mike about 0-forces. Nor had I talked about the intricate series of resonant pathways that is involved with donning a pair of gloves. I looked at Mike's face, and he had a kind of glazed look in his eyes. I began to think of us as two waveforms side-by-side; and just like the waveforms of two tuning forks standing side-by-side, our

waveforms were resonating with each other. Our thoughts, which themselves were resonances that had been established in our brains, were waveforms that could resonate with similar waveforms. Our thoughts had become sufficiently attuned that they had started to resonate with each other, and my thoughts became Mike's thoughts. I suddenly realized how telepathy was possible.

I felt I had to leave. Mike was staring fixedly into space, apparently fascinated by the implications of 0-forces and 0-motion. He was clearly caught in a resonant pathway that he would not soon escape. I wondered if it would turn out to be one of the same resonant pathways that I had traversed, or a new one that would lead to a different destination.

I could not wait to see. I left him there. A silent figure sitting on a stool beside a silent figure lying on a table.

As I hastened past the receptionist, I wondered when Mike would recover his senses; and when he would summon his aides into the operating room. Would he cut open the brain of his epileptic patient and begin to rummage among all the parts he knew so well? Would he look for the memories that he was sure were in there? Maybe for now, yes. But I suspected that one thought would lead to another, *and* he would begin to think more about vibrating strings *and* tuning forks, which might lead to his thinking more about Relativity and Quantum Mechanics. And where the universe came from. Until then, just as the Hottentot in front of the television set, all he could do is rummage.

A Contemplation of Souls

As I walked back past the tree in the quad in front of the hospital, I realized that my outlook on what I was doing

was in the process of undergoing a change that was ominous and threatening. It was not our memories being Past waveforms that was directly threatening; but that if it were true, it implied that my perception of the world as well as my perception of myself were seriously flawed. Up to now, my philosophical musings had been uplifting and comforting. When I first began thinking about the implications of "that which cannot be observed does not exist," I had hoped for guidance toward the fundamentals of how to live, what is right and wrong, perhaps something about the existence of God, and especially whether we have a purpose for our existence. This compass became like a toy, and when I played with it, it pointed toward answers to life's persistent questions. As with any toy that does tricks you do not expect, I was delighted with it.

Just as Midas was delighted when his wish to be able to turn anything he touched into gold, allowed him to turn his slippers into gold. He proceeded to touch other things to turn them into gold. But then he discovered that there were some things that he did not want to turn into gold. Like his lovely daughter. But his wish did not discriminate, so when he touched her she became a golden statue, much to his dismay and great sorrow.

What if, as Midas did, I have actually gotten my wish? What if "that which cannot be observed does not exist" is indeed the One Fundamental Law of the Universe, and all things grow from this root? If it is, then to fully understand this Law, to think through its logical ramifications, should unerringly lead to answers to all questions. But perhaps there are some questions I would rather leave unanswered; some things that I prefer would remain mysterious and impervious to human inquiry. In the face of such questions, suddenly my compass is no longer a simple toy, but becomes a fearsome weapon that bludgeons its way for-

ward to places that I may not wish to visit. Like a huge mastiff on a chain attached to my wrist. Perhaps because I raised the mastiff from a puppy, I think that I can control him. But now that he is grown, I realize that he is out of my control, and if he chooses to chase down a lovely deer and rip it to bloody shreds, there is nothing I can do to stop him.

I see this possibility hidden in the idea that brains form and recall memories by resonating with Past waveforms. If it is true, it is an idea that goes beyond my control. It is not just a clever trick of a toy that reveals what inertia and momentum are, but something that threatens to alter the meaning of everything I have ever known. It says that the world is something completely different than what I had thought. My senses have told me that there are three dimensions, and science has corroborated this. Time has been tossed in as a fourth dimension, but merely as a curiosity. We wonder at it, especially the fact that it goes only one way. We use Time, and refer to it constantly. But once something has passed into the Past, it is gone. Now it seems that Time may be a Dimension that is a tangible place that contains our memories, thoughts, and feelings, and is a place that we visit frequently. Although the tip of a root is a vitally important part of the root because the root-tip is what allows the Future of the root to unfold, almost all of the substance of the root is not in its Present, but its Past. Similarly, our Present Moment experiences are an almost insignificant veneer on the total substance of our lifetimes. If the memories of this Past lifetime lie in another Dimension, and if we reach into this Dimension in order to access our memories, then for all practical purposes, that other Dimension is where we actually exist, and the Present Moment is merely the means by which we access the Future.

This is a potentially exciting and exhilarating discov-

ery. But it is also ominous and threatening because, if it is true, it would force a re-evaluation of the meaning of everything. Most people are not prepared to do this. I do not know if I am prepared to do this. Since I left Mike, my sense of what I need to do next has changed. Before I went to see him, I had assumed that I could just toss the whole idea out once I had seen its flaws. Although it had been fun up to then, playing with ideas that seemed to provide profound insights about the universe, I felt it was pretty likely to turn out to be a lot of hogwash. Who am I anyway, to think up solutions to these questions when so many others have failed? I am pretty ordinary when it comes to smarts. I always had to work really hard in school to get decent grades, and didn't always get them even then. So there was always this deep-down feeling that it was all ephemeral and would come to nothing. I really meant it when I told Mike that my purpose of going to see him was so he could destroy my house of cards with a hurricane of logical thinking. We didn't have time to cover all that much ground, but we did get into some substantive things; and these were impotent in deflecting the direction in which my compass pointed.

I let some of the ideas that Mike touched upon run through my mind, such as the positron-glucose experiments where brain activity occurs in the same part of the brain when you see a cube as when you remember it. That is exactly what you would expect to see if the visual cortex were acting as a resonator, both in creating the memory waveform of the cube, and in recalling it. Then I remembered other experiments which show that thinking of a word, hearing a word, and saying a word can all occur in different parts of the brain. This can be reconciled by the fact that just because it is possible for a particular resonator to act both as a transmitter and receiver doesn't mean that

it necessarily does; as illustrated by radio "transceivers" whose transmission and reception roles are typically performed by separate resonator circuits. Nature is flexible, so might employ either strategy, depending on the circumstance. Mike also described how memories seem not be stored in a particular place, but "all over;" like a hologram. That fit too, because the fact that the memories are safely tucked away in a different dimension, means you cannot destroy them; you can only destroy the resonators that are necessary to recall them.

Then I thought about Alzheimer's disease, which slowly degrades the memory until it is finally gone completely. Autopsies on Alzheimer's patients show that their brains have become filled with tangles of "amyloid proteins." These tangles form everywhere, causing minor memory lapses at first, and finally total memory loss as they become abundant.

This agrees perfectly with the resonator idea. One can think of a silver bell, that rings with a full pure tone when you strike it with a hammer. Imagine that the silver metal of the bell slowly turns into grains of sand. At first, it would not matter much when you strike the bell, but as the grains grew in number and size, it would begin to sound dull when you strike it. As the sand grains began to dominate, the bell would cease to ring at all. So with the brain as it fills up with amyloid tangles. When the tangles are small and few, they would interfere only slightly with the ability of the brain to resonate to create and recall memories. As they increase in size and number, the ability of the various parts of the brain to resonate would degrade, so our ability to form and recall memories would degrade; and the pattern of memory loss would depend on the details of how the amyloid tangles advance through the brain. When the tangles become large and abundant, just as with the silver

bell filled with grains of sand, the brain would no longer resonate at all; and the person would exist only in the Present Moment, with no access to Past experiences. Advanced Alzheimer's patients just lie in bed and stare at the ceiling. It is as if their identifies as human beings are completely gone.

When I left Mike, my first thought was to further pursue what we had been doing, which was to go over the results of experiments that have been done on people with brain damage, to look for things that would prove that the idea of our memories existing as Past waveforms is untenable. I imagined rushing to the home of some famous brain scientist that specializes in brain damage research and banging on his gate. Drain him of everything he knows about experiments with brain damage. But as I thought of doing this, I began to be afraid. Not afraid that we would come up with something that would discredit the idea, but that we wouldn't. That he would proceed to lay out years and years of experiments on the brain that had produced results that had proved unfathomable by any conceivable theory. And that every one of them would fit perfectly with the brain being a collection of resonators and that memories exist in Past waveforms.

If I were to explain my theory to this brain scientist, perhaps he would think that it was intriguing and worth pursuing. He would do this by thinking up new experiments that had not been done before, and he would predict the outcomes of those experiments based on my idea. What if he then did those experiments and got those predicted outcomes? That possibility was really frightening. A philosophical idea usually remains just an idea forever, because there is no experimental way to test it. But this idea makes predictions that seem experimentally testable. It not only predicts that the brain is a collection of resonators, but that

motion is a chemical reaction, and that the tendency toward Reality is a new Force of Nature that participates in gravity and the progress of the evolution of the universe and of biological systems. It also predicts that we move our bodies by psychokinesis. Although the experiments one would have to do to test all these predictions are not immediately obvious, the human mind has demonstrated itself to be fiendishly clever at thinking up ways to test ideas. So I have much confidence that meaningful experiments could be done.

When you start testing a hypothesis by predicting the results of outcomes of experiments, you are actually doing science. And if your hypothesis correctly predicts the outcome of every experiment you can think of doing, science says that you are forced to accept the hypothesis. At least until an experiment with a result that conflicts with the hypothesis comes along. Suddenly, I realized that I did not want to know that the idea was consistent with all the experiments that had ever been done, nor did I want to know that it could correctly predict the results of experiments designed to test it. Because if these things were done and the idea could not be discarded by the results, it would remove my doubt that it was correct. And I needed my doubt to protect myself from the effect of this idea, which threatened to turn my life upside down.

It has been some time now since I went to see Mike. I have tried to let everything about tuning forks, waveforms, motion as a chemical reaction, the brain as a resonator, and our memories as Past waveforms recede into some distant corner of my mind. It rests there, and I do as little as I can to disturb it. But it disturbs me. I discover that my perception of the world is changing, day by day.

I raise my hand to rub my chin, and I think of how my hand arrives at my chin by a psychokinetic process in

which my neurons utilized their powers of exerting 0-forces, causing the Curling energy of my muscles to move my arm. In arriving at my chin, my hand followed a resonant pathway that was cleared by my neurons, like the curling sweepers sweeping a path for the curling stone to follow.

I drive my car, and I watch as other cars pass in both directions. I reflect that they are moving by an erasing-and-redrawing process like the Mona Lisa's hand moving across a computer screen. I think of how this motion is really a chemical reaction.

I go to a play, and I think of how the actors are wave-forms moving in front of me, and how their ability to pretend to be something that they are not is an incredible skill, because they do not have the luxury of simply resonating with their past experiences as the upper-class Englishman does. In a production of Sean O'Casey's *Plough and the Stars*, Nora, in the last scene, seemed to incandesce with something that reached out and gripped the audience in a way that surpassed understanding. I actually felt a kind of power reach out and envelop me, like a wave. I thought, "Maybe it is a wave." That this actress, who was focused on what it is like to be another person, and that this other person was in emotional agony, injected her emotional energy into her neurons, which exploded outward like a flash of light, and we were trapped in it. And as this flash passed through us, we resonated with it; like tuning forks resonating with a violin string. For those few moments, while Nora's energy flashed throughout the auditorium, all who were trapped in its glow became like one person, with a merging of thoughts and feelings and experiences. Not just with Nora, but among themselves. I thought of this as Nora took her bow. Although exhilarated, she was clearly drained of energy. The lights came up, and as I stood up, I

looked at the faces of others as they stood up. Everyone was looking at everyone else. Although all were strangers to me, I felt I somehow knew them all. And that they knew me, and each other. I thought, "So this is how Art can communicate to bring people together."

I then thought about the fact that whereas this particular performance had produced feelings of unusual intensity, it was not unlike the experience of going to any play that is performed well. Actors and other performance artists frequently assert that performing for a live audience is completely different from performing without one, and audiences agree that seeing a film of a play is a completely different experience from seeing a live performance. Performers say that they feel a kind of energy from the audience. I have performed some as an actor and singer and have found this to be true. When I am a member of the audience, I certainly feel energy from the performers. Whereas everyone agrees that this exchange of energy is completely real, no one has any idea of what the energy is nor how it is exchanged. Although I try to keep resonators and waveforms pushed into the corner of my mind, that corner of my mind whispers that it has the answer.

What I find most disturbing is that my mind often falls into a train of thought that I now recognize as a resonant pathway. It starts like daydreaming in which an idea floats in like a cloud, and this triggers another idea, and this another, until I find myself thinking about something completely different from where I started. My compass, or now my raging mastiff, is constantly taking me down these pathways, and sometimes I don't like where I find myself going. I find myself thinking about things I don't really want to think about, because they are too disturbing to my perception of myself and the world. But they are invariably interesting, and illuminating, while they are disturbing.

The Soul as a core belief in world religions.

Places that my mastiff is constantly dragging me are to the Nature of the Conscious Mind, and the Soul. I was at first pleased to find myself at these places, because I began to see what they were. But then came the darker side. My mastiff dragged me to where I was seeing into the nature of the afterlife, and that our Souls are immortal things, and that we have lived through many lives and will live through many more. These were profoundly disturbing ideas to me. I was raised in the Christian heritage, but in a family that did not indoctrinate me with respect to religion. To me, there was no such thing as heaven or hell, and when I died I would not sit beside God's hand, but rest in the ground forever with my mind in eternal nothingness.

As I have lived my life, experiences have taught me that things might not be so simple. So many people have confidence in the existence of God, and that there is someplace we go when we die, that it is impossible to discount them entirely. People of high reputation have recounted experiences that suggest there is something substantive about what is called the paranormal. They report having Out of Body Experiences, and Near Death Experiences. That we move through a tunnel toward a light when we die has become a cliché that many people believe. Hypnosis has found many people who recount former lives. I have tended to give these things minimal credence, attributing them either to lies or hallucinations. But my mastiff has been dragging me around and showing me things that suggest that they are not all lies and hallucinations.

It is interesting how many people have managed to totally separate their ideas of God, the afterlife, and so on, from their everyday existence. Scientists who are completely skeptical of any manifestation of the paranormal

may feel completely comfortable that there is a God who is controlling things, and that when they die, their Souls will somehow continue on. There seems to be a feeling that the nature of God and the afterlife are things that are forever sealed from our understanding, and that since they are sealed, then whatever we see of them must be a sham. But this seems unreasonable. If there is a God, and there are departed Souls, then it is inescapable that they be someplace. We humans have been looking around and poking into everything, and have not found anyplace that they could be. So we start thinking fuzzily about it, and wander off satisfied that whereas they are somewhere, they are nowhere.

We appear to be restricted to living in three dimensions, whereas physicists see that the universe may have many dimensions. Perhaps departed Souls occupy another dimension that we cannot sense, which could explain why we cannot find them. But if any of the reports of the paranormal are true, then it seems that this other dimension, even though it is more or less undetectable by us, nevertheless interfaces with us in a way that we can perceive at least some of the time.

Time is a likely candidate for such a dimension. It is a dimension that is not completely unknown to us, like say, the fifth dimension is. Although we cannot arbitrarily move back and forth in the Time Dimension, we nevertheless see that we move along it. Since we have never been able to see into the Time Dimension other than the Present-Moment point, we do not think of it as playing a significant role in our lives. But my compass has pointed toward the possibility that our memories reach back into this Time Dimension, and that when we recall memories, we are gaining access to this Dimension. We don't literally reach into it, because the resonating brain that is responsible for retrieving memo-

ries from the Past waveform exists at the Present Moment. But despite the fact that we cannot actually reach into the Past, the fact that the Past holds our memories in such a way that we can interact with them, means that the Past is a substantive thing, and not just an ephemeral concept.

It is also obvious that if the waveforms of our brains are extending into the Past, then there are other things back there too, and these must include the waveform of every object of the universe as it has traversed through Time. Remember that once a waveform has moved into the Past, it remains as it is for all Eternity, because it has lost access to the Present Moment, and it is only at the Present Moment that energy can either be put into or removed from the waveform, so the Past waveforms of ordinary objects can never change. Whereas our brain can explore the contents of its own Past waveform through resonance, it is not connected to any of these other waveforms, so they cannot be perceived. But they must be there, in the Past. And if these things are there, why not other things? Like God, or departed Souls?

My mastiff has dragged me through some thoughts about this. I don't know that I like these thoughts, but they are what happened when I slid through the resonant pathway opened by the idea that our brains are resonators that resonate with Past waveforms. It is a long pathway that starts with ideas that were presented much earlier, with many twists and turns. The destination of the pathway is the Nature of the Soul, and its relationship to our Conscious Mind, and the Afterlife. Not surprisingly, this pathway zigzags across the pathways of the great religions, which have explored these ideas in considerable detail.

Because of our role as Observers, I accept the idea that humans are consummate Observers, and although the observations of an individual may be faulty, the collective

observations of humanity are trustworthy. One can therefore have great respect for any idea that has persisted through the ages and is believed by many people, because if the idea were entirely false and without merit, it would not square with their observations and they would reject it. This is not to say that all ideas that have persisted are to be blindly accepted. Many Hindus do not believe that the universe is sitting on the back of a turtle as their tradition says, but they do suspect that it is a metaphor for something that is true. Almost all the current-day religions grew either from Hindu roots or Judeo-Christian roots. As they stand today, the Hindu-derived religions seem largely incompatible with the Judeo-Christian-derived religions, which suggests that one group or the other has been making faulty observations. My mastiff says "no" and pulls me down the resonant pathway that consists of the core beliefs of these religions.

A core belief in the Judeo-Christian branch is that an all-powerful God created the Universe and placed Man in it to reign over it. The first thing God had Man do was to give names to things, which required making observations of them, thinking about them, and remembering them. Christianity developed an additional core belief that Jesus is the Son of God, and was sent by God to provide the Good News (Gospel) that all humans would have everlasting life, that our Souls would be saved, and that after we die, we will dwell in the Kingdom of Heaven with God, and the Son, and the Holy Spirit. These Judeo-Christian ideas dominate most of the people of the Western World.

The Hindus have a rather different view of things. Their core belief is that our universe is filled with an infinite number of Souls, and that these Souls have existed forever and will exist forever. These Souls seek salvation through an endless succession of lives, which can be experi-

enced in any living creature, but when in human form can perform deeds that accumulate merits and sins. The only way to attain salvation is to live lives that are so meritorious that the sins waste away; when they are extinguished, the Soul is released from the cycle of births and deaths; whereupon salvation is attained. This process of attaining salvation takes a very long time because it begins in a state of primal ignorance from which one must rise by one's own bootstraps. Since there are an infinite number of Souls that have existed forever, the progression of Souls from primal ignorance to salvation is an eternal process that is longer than any universe can last, so there has been an endless succession of universes; and this succession will continue forever. This core belief has survived among the modern religions of India and Asia, and therefore has billions of adherents.

Politicians who seek peaceful accords between these two different religious branches despair because they seem completely incompatible. If you adhere to the precepts of one, you must abandon the other. For both to exist together demands that the members of one group exhibit tolerance and forbearance toward the other. We have gotten reasonably far with respect to tolerance and forbearance, but there is virtually no expectation that these incompatible religions will ever merge. But as my mastiff has been dragging me around and showing me the implications of resonance, I have discovered that the core beliefs of both branches of religion are compatible in almost every detail. It is just that each of them is concerned with a different aspect of the way the universe operates. Whereas both Hinduism and judeo-Christianity address the questions of where we came from and where we are going, Hinduism focuses more on the process by how we got to where we are, whereas Christianity focuses more on the now and where we are going from

here. Because they focus on different things, they appear to be very different religions, but when you back off and look from a longer perspective, you see that both of them are engaged with the same larger ideas.

An important Hindu idea is that the Soul is an entity to which the mind is attached, and it occupies a body for its lifetime. When the body dies, the Soul departs and seeks a new body, although an indefinite period of time passes until it chooses one. The Christian idea of the Soul differs mainly in that it does not invoke the search for a new body, although it apparently did in early Christianity; until the concept was arbitrarily excluded in order to discourage faithful Christians from postponing pious behavior until future lifetimes. Certain Jewish sects hold that the Soul passes through a limited number of lifetimes, about five. The Hindus say that the Soul has existed forever and will exist forever unless it achieves salvation by living meritorious lives. Christians are silent about where the Soul comes from, but believe it is going to heaven if it is meritorious, or to hell if it is not. The idea that the Soul is an entity is deeply entrenched, and it is what defines one's sense of self, or Being. The Soul is somehow wrapped up in our consciousness, and our consciousness provides an awareness of who we are, where we are, and when we are. Both the Hindu and Judeo-Christian religions hold that the Soul is something that is separate from the flesh, and although bound to the flesh while we live, it is released when we die.

The Philosophy of Observation says that everything exists because of observations, and all things are waveforms. Since there is nothing except observations and waveforms, and the Soul cannot be an observation, it must be a waveform. Like the waveform of a hydrogen atom, it is eternal. Like the waveform of a hydrogen atom, the only way it can undergo change is to absorb energy or emit energy. It

can do this only at the Present Moment, and once the Present Moment has moved into the Past, the waveform of the Soul, like all waveforms, will exist as it is forever. However, this does not necessarily preclude the possibility that a Soul in the Past can participate in the Present Moment. This is because of resonance. If we can reach into the Past by means of resonance, it should be possible for a Soul in the Past to interact with the Present Moment through resonance.

The Soul as a waveform.

Let us think about the nature of this waveform Soul. Where would this Soul come from? Where all waveforms come from, which is the multitude of quiescent waveforms that comprise a vacuum. The Hindu idea that there are an infinite number of Souls and that they have existed forever and will exist forever sounds very much like the description of the vacuum filled with a multitude of quiescent waveforms. Any one of them, if it could get access to an appropriate source of energy to enable it to change and evolve, could evolve from a state of primal ignorance to an understanding of good and evil. Whether it does this through conscious effort or lucky accident is hard to say. For it to evolve at all requires that it be able to follow some pathway of evolution; one that leads to consciousness and the ability to make judgments and decisions, and to act on these decisions.

An idea that is currently popular with scientists is that the brain is a complex computer and that consciousness is something that happens spontaneously when a system gets sufficiently complex. Whereas your desktop computer is clearly not conscious, if you built a computer that was a

million times larger and a billion times more powerful, then perhaps it would become conscious once it had been able to "learn" using the principles of the Neural Network.

However, the intensification of Reality that is achieved by neurons argues that the brain is fundamentally different from a computer. The neuron is different because it contains billions of tiny components that are all interconnected by means of triangulated forces, and when the neuron "fires," all of the components dance about, pulling and pushing on their strings and sticks, which creates an instant of intense Reality. Moreover, it is also argued that the actions of neurons are recorded as memories in Past waveforms, and that memories are extracted from these waveforms through resonance.

No matter how complex you make a computer, the solid-state electronic components we have employed up to now can never possess the quantum mechanical attributes of a neuron with all its myriad components moving around and interacting in solution. The electrical components will never be able to intensify Reality, nor to create or consult a memory waveform. Unless we can think of a way to give computers components that duplicate the quantum-mechanical properties of neurons, with their billions of mobile and mutually interactive chemical components, it will be forever impossible for computers to think or behave as we do.

The evolution of the Soul.

We now need to think about how a Soul might be involved with neurons, and how the Soul might evolve. As argued earlier, neurons are cells that have evolved to specialize in their ability to intensify Reality. Once the neuron

is functional and capable of observing and intensifying the Reality of its surroundings, a window opens that allows the neuron to do things to protect itself from harm. But a neuron, all by itself, is capable of doing only one thing, which is to make observations. This is not the same thing as making judgments, nor taking action based on those judgments. If you approach a snake that has a rattling tail and you know nothing about rattlesnakes, your neurons will die. If a rock comes flying toward your face and you know nothing of rocks nor how to move your arm to deflect it, your neurons will die.

There is clearly a very strong evolutionary pressure in favor of neurons being able to learn and to take action based on that learning that results in self-protection. However, the neuron is nothing but a waveform that is highly specialized in its ability to intensify Reality by making observations. Just because a neuron has made an observation, thus intensifying Reality, does not mean that it can make judgments about the significance of the observations, nor to make decisions about what to do based on judgments. If the neuron cannot make these judgments on its own, what it needs to do is to recruit a partner that can help out in a way that provides access to the ability to learn and to make decisions based on that learning. Since there is nothing but observations and waveforms, this partner must be a waveform. Theoretically, any quiescent waveform plucked out of the vacuum could do the job, and the lucky waveform that is recruited to cooperate with the neuron will have taken its first step up the ladder that leads to salvation. We will call this helper waveform that enables the neuron to learn and make decisions, the Soul. It is bound to make some mistakes, but once it is on board, the Soul and the neuron can cooperate.

Cooperation in this case constitutes a symbiosis in

which the neuron will provide a source of energy, by means of its metabolic energy, to allow the Soul to undergo changes in shape and to evolve. The Soul will do its part by telling the neuron what to observe, and these instructions will enable the neuron to make observations that favor survival and to avoid danger. The neuron does not need to know how the Soul knows what to do, it just has to follow its instructions. Since the neuron knows how to make observations, it can perform its role by catalyzing the chemical reaction of motion within muscle cells. Upon being told to do so by the Soul, the neuron "observes" muscle cells in an appropriate state of contraction, thus exerting 0-forces that trigger the Curling energy in our muscles to perform appropriate 0-motions, such as moving an arm to deflect a rock from hitting us. In other circumstances, the Soul instructs the neurons in the seeking of food and shelter and sex.

We now need to explore how the Soul makes decisions and communicates them to the neurons for execution. The means by which we know how to behave in any situation is through experience. If you encounter a rattlesnake and have experienced rattlesnakes, you will either try to kill it or run away. If you see a rock flying at your face, prior experience tells you to raise your arm to deflect it. The knowledge of what to do is derived from our experiences, and I have argued that the memories of our experiences reside in a waveform that extends into the Past. It thus appears that the Soul has evolved a capability to consult the Past memory waveform and use the information it finds there to make decisions about what the body should do.

Without the ability of the Soul to access the information in the memory waveform, the body would not know which observations it should make in order to survive. Without the body to provide metabolic energy, the Soul

would not have access to the energy it needs to evolve and improve. This is a true symbiosis, in which each symbiotic partner makes a crucial contribution to their mutual needs. Either the Soul or the neurons alone would be helpless. But in symbiotic cooperation, they can not only survive, but manipulate the future of the universe.

We need to consider the process by which the Soul extracts information from the memory waveform that extends backward into the dimension of Time. To see how it might do this, imagine one of those electronic musical instruments, called a theremin, that you play by waving your hands in the air around it. The instrument is designed to be sensitive to changes in capacitance, which occur when you hold your hands in different positions near it. If you stand completely aside, the instrument gives off just a steady, featureless hum. But if you approach the instrument with your hands, the pitch that it produces changes. A little experience with waving your hands back and forth around the instrument allows you to play weird-sounding tunes. You may find that when you place your hands in certain positions, ugly sounds are produced, but other positions produce pleasing sounds. By learning which positions produce which sounds, you can concentrate on making pleasing sounds and excluding the rest.

Now suppose that the role of the Soul is analogous to role of the hands, and its job is to evoke pleasing resonances with respect to the memory waveform. Suppose the Soul is a waveform that surrounds the Present-Moment end of the memory waveform, and can move around and change its shape in the vicinity of the memory waveform. As the Soul performs these shape and position changes, it would evoke resonant responses from the memory waveform, and thus influence and control what memories are evoked and thus what thoughts are thought, and what deci-

sions are made. One can imagine that the Soul searches for memories that provide particularly pleasing resonances; resonances that "make sense" and are "harmonious" and "beautiful." Perhaps "thinking" is really the Soul moving around, encircling and cuddling its memory waveform, until it locates the most perfect and harmonious resonance it can find. If you are trying to decide among alternatives, this most perfect and harmonious resonance is your "decision." If you are trying to create something, this most perfect and harmonious resonance is your "idea."

This tells us why different people have different responses to situations, because each of us has a Soul that is unique, and its uniqueness lies in how its waveform shape, and thus its ability to resonate, has evolved in response to life's experiences. Each of us also has a unique memory waveform, because each of us has had a different set of experiences that have been recorded there. Thus, when your Soul searches your memory waveform for resonances, the only resonant responses that are possible for you are those that your particular Soul can derive from within your particular memory waveform. A different Soul might find different resonances within your memory waveform, but you are stuck with the Soul you have. Your Soul might find different resonances if it could search a different memory waveform, but the only memory waveform it has access to is yours.

If you take many different individuals and place each of them in the same particular situation, each individual is liable to make a unique choice as to what to do. Suppose a gentleman sees a little old lady crossing the street. His impulse might be to help her. The impulse of a thief might be to snatch her purse. An arrogant little boy might jeer at her. A little girl might go up and hand her a flower. A policeman might arrest her for jaywalking. Her son might

see her and invite her to dinner.

Each of these individuals would perform these acts with very little hesitation as to what to do, and each of them would behave consistently. On another day, you would not find the little girl jeering at the old lady, nor the thief helping her across the street.

Each of our Souls has clearly gone through a complex process of evolution, that reflects the symbiotic relationship between the Soul and the collection of neurons with which it is associated. When certain Souls search certain waveforms for harmonious resonances, the resonances that they find may ultimately prove detrimental or even fatal to the neurons. Suppose the thief that snatched the old lady's purse was gunned down by the policeman as he tried to make his getaway. Up to that moment, the Soul had been doing its job the best it knew how, which was to resonate with the thief's Past experiences as best it could. The resonances that it evoked led to unfortunate consequences, and the thief's Soul and body were forced to part company.

But consider the person that helped the old lady across the street. He may have done this because the old lady reminded him of this mother, who had loved him and had been good to him. As he watched her make a tentative step off the curb, his Soul cuddled his memory waveform and searched for the most harmonious resonance it could find. When it found the resonances of his mother's love, his "decision" was to be loving in return, and he rushed over to take the old lady's arm and help her.

The thief may have had a mother who beat him, and when he saw the old lady, what may have resonated with him was revenge. Whereas the thief died because of this unfortunate resonance, perhaps the helpful gentleman's boss observed his good deed, and decided that this was a man whom he could trust. So he promoted him to a posi-

tion of high responsibility and gave him a large raise. This increase in income made him affluent enough to get married, and he sought a girl with whom he resonated. They had a family. The girl he married turned out to have the same loving qualities as his mother had and was loving to her children and was good to them. They all lived happy and productive lives, and there were more children down the line. The thief had none of this. Poor Soul.

One can see that there is a powerful force at work that favors a process by which the Soul can improve the chances that the collection of neurons with which it is associated can survive. The only things that can determine what decisions the Soul can make are the shape of the Soul waveform, and the memories that are stored in the memory waveform. The Soul can improve its contribution by tentatively experimenting with changes in its shape. By changing its shape, the Soul will evoke different resonances from the memory waveform, just as changing the shape of your hands would change the sounds that the electronic instrument would make as you waved your hands around it. The Soul dare not be hasty, since a mistake could be disastrous. In order to change at all, it has to have access to a source of energy, which is the metabolic energy of the body with which it is associated. Changes in Soul-shape that lead the body to make fatal errors of action will cut the Soul off from the possibility of making future improvements. On the other hand, Soul-shape changes that lead to favorable circumstances for the body will allow the Soul to continue its process of evolution toward perfection and eventual Salvation.

One of the things that the Soul must work toward is improving the qualities of the memory waveform, since no matter what it does to its own shape, unless the memory waveform contains experiences that can resonate with ben-

eficial results, then bad things will occur. Unfortunately, the Soul is not able to fully control the circumstances that contribute to the formation of the memory waveform. If the Soul had a choice, it would guide the body into loving relationships that would provide memories with beneficial resonances. But suppose the body is surrounded with nasty people who provide nothing but experiences that generate memory waveforms that provide unfortunate resonances. Such an individual will do bad things. We can see that punishing such an individual does not do a great deal to help things. If you had a violin that produced ugly music because it was constructed of wood that produced bad resonances, it would be stupid to try to improve it by hacking at it and making cuts and dents in it. It would only make matters worse. The only thing that would make sense would be to change the structure of the wood somehow. Replace some of the bad wood with good wood. Beautiful music from a violin requires both an instrument that is capable of producing beautiful resonances, and a violinist with the ability to find those resonances. The Past waveform is the violin, and the Soul is the violinist. Because the Soul participates in the building of the waveform in the first place, one could say that the Soul participates in the construction of the instrument it will play.

This says that in order for people to improve, they must first of all have some good experiences under their belts. These obviously start in the crib, with loving parents who establish a memory waveform in the baby that resonates with love. Such a baby will tend to respond to the circumstances it encounters with the only thing it knows, which are responses that resonate with love. If these encounters lead to good circumstances for the baby, the baby's Soul can grow, and it can tentatively grow in a way that will, with good luck, improve things even more. If the

Soul grows in a direction that causes deleterious things to happen, it can retrench and grow in a different way. A Soul that finds itself in good circumstances can grow a great deal in beneficial ways. The path it will follow as it develops will coincide with what we would call good moral development. Such good development is only possible in an environment in which the improvements that the Soul makes result in benefits to the body. A Soul that experiments with generosity and is rewarded by nasty people snatching all its bodily possessions will retrench and grow in a different direction; one in which its bodily possessions are protected, perhaps with filthy words, or fists, or knives, or guns.

Although this response may eventually lead to the Soul's body lying dead in the street, the Soul has no choice but to make responses that resonate with its experiences. If, as a society, we wish to prevent this, we must seek a way to provide every person with experiences that establish memory waveforms that permit the making of resonant choices that are beneficial to all.

We see that there is a natural process by which a Soul with a good shape, that is associated with a good waveform, can continue easily along a path of continual improvement because there is a resonant process by which the good Soul leads to a steadily improving waveform, and this facilitates further growth of the Soul in a good direction, which in turn leads to an even better waveform, which leads to more growth of the Soul in a good direction, and so on toward better and better.

But the Soul that has gotten involved with an unfortunate waveform, which could occur by circumstances that *are* totally out of its control, can get mired down and be unable to escape. Without a good waveform that can provide guidance to *the growth of the Soul*, the Soul can take

an unfortunate turn that leads to an ever-more deleterious waveform, which leads to further deleterious growth of the Soul. Once in this tailspin, the Soul may not be able to escape. It is in danger of falling back to the bottom of the ladder, into the Chaos of the vacuum of quiescent waveforms from whence it came, to once again be one of an infinite number of waveforms aspiring to evolve. Since the chance of any Soul advancing up the ladder of evolution is infinitesimal, it will have to wait for a very long time before it encounters an opportunity to emerge again. Perhaps slipping back into this Chaos is what Hell is.

It appears that the only hope for a Soul that is slipping into this morass is for those who are more fortunate, with their better-shaped Souls that are cuddling and resonating with memory waveforms that contain beneficial experiences, to extend a helping hand, helping to provide better experiences for this poor Soul. We would want to do this, if for no other reason than if we found ourselves slipping, we would want someone to extend a helping hand to us. If we are truly slipping, we can clearly not save ourselves all by ourselves. We must have help. This puts the need for helping the unfortunate in a new light. Perhaps those who are in good shape with respect to Souls and memory waveforms would rather not bother. But someday, the shoe will be on the other foot. It is therefore in our own best interest to help other Souls when they are struggling, because when the day comes that our own Soul is struggling, and it is sure to come; we will need other Souls to help us. It is inconceivable that any of us can successfully climb the ladder alone.

We now need to think more deeply about the Soul and its symbiotic relationship with the body. This symbiotic relationship was established because neurons, all by themselves, can do nothing but make observations that result in

an intensification of the Reality of what they are observing. Although neurons have the capability of altering what they are observing by exerting 0-forces, which result in 0-motion, they do not do this of their own accord because they have no reason to do so. They are merely "observing machines." By being merely observing machines, they have no way of enhancing their own survival as a consequence of a decision-making process. In order to acquire this decision-making power, they have resorted to recruiting a waveform, which was ultimately derived from the chaotic vacuum just as all other waveforms have, to become a Soul. We have seen how this Soul operates, by searching for resonances by cuddling the memory waveform that is generated by the neurons with which the Soul is associated.

The components of the Soul.

This means that each thing we do, every tiny action we take, is dictated by the sum total of our life's experience. The way we take a step, the way we wave a greeting and say good morning, whether we walk against a red light, whether we love our mother and how we react to strangers-are all determined by these resonant responses.

To do its job properly, the Soul should have access to as much information as possible about what predicaments its neuronal symbiont is getting into, and as soon as possible. It would logically extend itself so that it reaches as far as possible toward the source of this information, which is the exterior of the body.

A Hindu belief is that the Soul grows to a shape that mimics the shape of the body and extends from the top of the head to the toes and out the arms to the fingertips. If you were to "see" this part of your Soul, it would be shaped

exactly like you. Thus, the Soul must consist of two parts, one of which functions to evoke resonances from the memory waveform, and the other to act as a resonant antenna that interfaces with the experiences of the neurons. These parts are joined in some way, so that the resonant pathway that exists between the Present-Moment experiences of the neurons and the Past experiences stored in the memory waveform is complete. Put in this light, the job of the Soul is to provide a kind of gateway to this resonant pathway, to control which resonances will actually succeed in going back and forth between the neurons and the memory waveform. Because it has a particular shape, selected through a lengthy process of evolution, the Soul can influence the way that our Present-Moment experiences resonate with our memory waveform, and also influence how these resonant responses will flow back to the neurons in the form of instructions for them to execute. The neurons will blindly perform according to whatever resonances they receive. If the neurons observe a rock flying in their direction, their resonant response as mediated by the Soul will be to "observe" an arm raising up to block it. Sure enough, this happens, because the resonant response evoked by the Soul caused the neurons to focus their powers of observation on the quiescent waveforms of those particular contracted muscle cells that will cause the arm to move in the appropriate way to deflect the rock. Those particular muscle cells undergo catalysis of motion, in which their shape moves from a state of relaxation to a state of contraction. The arm moves, the rock is deflected, and the neurons are saved. The Soul continues on the road to salvation.

When people hear of the Hindu idea that the Soul is shaped like the body, they often laugh and say, "What if I cut my hand off, would I see my Soul sticking out?" The

answer is obviously no, because many people have had limbs cut off, and no one has seen the Soul sticking out. But there is a fascinating phenomenon called "phantom limb syndrome," which people who have lost limbs experience. People who have had a leg amputated above the knee frequently report waking up in the middle of the night and feeling their entire leg. Some who had been troubled with arthritis in their foot and toes before the amputation report they still feel arthritic pain in their amputated foot when it rains, despite their foot having been cut off. Scientists are not frantic about being unable to explain this, for it is presumed to be a consequence of the fact that the brain is "wired" with neurons for the leg and foot, and even if the connections to the leg and foot are cut, the wiring in the brain remains. This could give rise to phantom sensations. That the leg-form of the Soul is still there to produce the phantom-leg sensation is merely another explanation that we might consider.

If the Soul does conform to the shape of the body, why doesn't it conform to the body's new shape that exists after amputation of a limb? And if the limb-shape of the Soul remains after amputation of the limb, why can we not see it? The obvious answer lies in the fact that the purpose of the Soul is to evoke resonant responses from our memory waveforms, and our memory waveforms extend into the Past. ***This means that the Soul also exists in the Past, and not at the Present Moment.*** Since our senses can only sense those things that "exist" at the Present Moment, they cannot detect those things that exist in the Past.

If we assume that the part of the Soul that is cuddling and caressing the memory waveform is in the Past, then how is it communicating with the body, which is in the Present Moment? I will argue that this is done by the "antenna" part of the Soul, which has grown to assume the

shape of the body. Although it is precisely the shape of the body, it does not exist at the Present Moment, but instead exists, perhaps, a fraction of a second, or an "instant" behind the Present Moment.

Since it is not in the Present Moment where our senses can perceive it, it is invisible to us when we amputate a limb. If we think of our bodily waveform in a continuum through Time, like a growing root with its root-tip at the Present Moment, then the Soul proceeds immediately behind the growing root-tip of the body, conforming to its shape, but progressing an instant later. It is like the membrane of a boiled egg that is found immediately inside the shell, and conforms to every nook and cranny of the shell so intimately associated it may seem glued to it, but it is not; and the shell can be peeled away to leave the membrane behind.

Because of its intimate proximity to the body and its antennae-like nature, the waveform of the Soul can resonate with the waveform of the body, thus giving the Soul access to the metabolic energy that the body produces in the Present Moment, enabling the Soul to undergo energy-requiring changes in shape, even though the Soul is in the Past. The antenna part of the Soul can ordinarily grow only as the body grows, where it remains constantly near its source of energy. If you were to lop off a limb of the body, the corresponding part of the Soul would be stranded away from its source of energy, and therefore cannot adapt to the change. Although you cannot perceive the limb-part of the Soul sticking out, it is there in the Past to plague *you* with phantom limb syndrome.

This line of reasoning leads to an astonishing revelation. Whereas our bodies exist at the Present Moment, they are nothing but Observing Machines and are not actually our Being. What actually defines our Being is a combina-

Born of our memories and our Souls. Our memories do not exist in the Present, but extend as waveforms into the Past. Our Soul also exists in the Past, and has to, because its task is to evoke resonances from the memory waveform. Although the antenna part of the Soul reaches toward the Present Moment, it does not quite reach it, so the Soul too, exists entirely in the Past. **Thus, all of the entities that constitute our Being, our memory waveforms and our Souls, exist in another Dimension, which is Time.** Our temporal existence is therefore a Virtual Reality that is experienced from this other dimension.

This is a breathtaking idea and is not at all in accord with how I have always assumed that the universe works. I have been dragged to this idea, not by my own volition, but by my mastiff who sat grinning and his tail thumping with enjoyment when I reached it. Now that I have reached this idea, I see that it is the door to a new resonant pathway. I really hesitate to go down it, because I have a feeling that what is down there is even more disturbing to my perspective of the universe than those ideas I have already explored.

Exploring the Time Dimension, as an Expanding Bubble

Let us toy with this idea a bit. Science and our senses tell us that the universe is a waveform that is expanding in three dimensions from the cataclysmic center of the Big Bang. Perhaps Time is also an expanding bubble. Just as the universe has an outer edge that is defined by the outer limit of its expanding three-dimensional waveform, Time must also be expanding outward. Since Time is a dimension that our senses are not equipped to experience outside the Pre-

sent Moment, we cannot conceptualize the expanding wave of Time. Does it have a center and is expanding in all directions? Does it start at a point and extend, say, to the "right"? It is as meaningless for us to ask such a question as it is to ask the Flatlander who exists in two dimensions to imagine what a sphere looks like. The Flatlander might be able to deal with it in mathematical terms, just as mathematicians deal with dozens of dimensions in their equations, but it is impossible for him to truly conceptualize it. Arthur C. Clarke once paraphrased J.B.S. Haldare by saying: "The universe is not only stranger than we imagine, but stranger than we CAN imagine." Since we cannot imagine the dimension of Time, his statement is literally true.

Whatever the expanding bubble of Time is like, the Present Moment with all its three dimensions is defined by the outermost edge of the bubble, with the Past being inside the surface of the bubble, and the Future lying beyond it. To our limited senses and minds, the Present-Moment outer edge of the bubble of Time is all that there is because the Present Moment is all we are capable of perceiving with our senses. But there is clearly much more to the Dimension of Time than this outermost edge, just as there is much more to the expanding three-dimensional universe than just its surface.

Imagine a bug that was somehow trapped within the surface of the expanding bubble of the three-dimensional universe, and can see nothing else than that. The bug cannot see forward, since the universe is defined by its outer surface, so what is beyond the surface cannot be seen until the surface advances forward. After it has done this, there is still nothing to be seen beyond the surface. Although the interior of the expanding bubble contains nearly all of the three-dimensional universe, if the bug cannot see the interior, but can only see the surface of the bubble, it would

eventually come to the conclusion that there is literally nothing else to the universe than its expanding surface.

We are exactly like this bug when it comes to Time. We can sense only the outer edge of Time, which is the Present Moment. We cannot see forward into the Future. Our senses do not allow us to see into the Past, not even a tiny instant; just as the bug cannot see inside the expanding surface of the three-dimensional universe. It is reasonable for us to conclude that the Present Moment is absolutely all there is, since that is all we can perceive. We know that because the bug cannot see the inside of the three-dimensional universe, he is missing a great deal, and if there were suddenly some way for him to see the inside, he would realize what he was missing. Whereas we have no problem seeing the inside of the expanding three-dimensional universe, we cannot see the inside of the expanding bubble of Time. Suppose we could suddenly acquire the ability to see inside the Time bubble, to see all of the Past that resides there? Although we feel we know the Past by means of a combination of the memories of our experiences, movies, and history books, perhaps if we could actually perceive the Past, there would be great wonders to be "seen," whatever "to see" would mean when you are in another dimension.

This perspective provides a view of ourselves that borders on the comic. It is as if we are trapped within the surface of a big bubble that is growing in size. The bubble is the expanding Dimension of Time. Inside the bubble is the Past, and outside the bubble is the Future; and we are trapped in the surface of the bubble, which is the Present Moment that contains the entire three-dimensional universe that we can perceive. Our bodies are imbedded in the surface of the bubble, wherein we experience the three-dimensional universe. All we can perceive is the surface of

the bubble, and can never turn our heads to see backward in Time, which is the interior of the bubble; nor to turn to see the Future, which is outside the bubble. All we can do is look around us, within the surface of the bubble, which is the entire three-dimensional universe as it exists at the Present Moment.

Although we cannot see it, because our senses are locked in the Present-Moment surface of the of the bubble, the interior of the bubble consists of the entire universe as it has progressed through Time, up to the Present Moment. All the Past waveforms of all the stars and planets, the mountains on our earth, the sea and all its creatures, and ourselves walking on the land are in there. The entire history of the universe is frozen in Time, because it is only at the surface of the bubble, at the Present Moment, that energy exchanges can take place and waveforms can change their shapes. Since the waveforms in the interior of the bubble have no access to energy, they will remain as they are for all of eternity.

Since the surface of the bubble is all we can see, we think that that is all there is. Since it is all we know, we do not mind being trapped at the surface of the Time bubble. There are sufficient amusements in the three dimensions of the Present Moment that we do not bother to concern ourselves with a dimension that we cannot see or experience. But just because we cannot experience the Dimension of Time, does not mean that it is not there. Perhaps it is filled with wonders that would both astonish us and delight us, if we could only experience them. Perhaps we have, and will again.

I look down at my mastiff, and he is still grinning, and his tail is still thumping. He rolls on his back and flails his legs joyously in the air. He is so pleased with himself!

But suddenly, he stiffens as if he has heard or smelled

something. He gets up and growls. He looks toward the open door that I suspect is the resonant pathway that I do not want to enter. His leash stiffens as he strains toward the door. I try to let go of the leash that is dragging me, but I cannot. I have no choice but to go through the door.

My first thought as I go through the door is, *What happens to the Soul when the body dies?* The resonant answer is that the body will simply slough away from the Soul, just as when you peel the shell off a boiled egg, you can leave the membrane behind. And there the Soul will be, just inside the expanding Bubble of Time. But since it exists an instant in the Past, it is not entrapped in the bubble surface which is the Present Moment. The bubble of Time will continue to expand, but the Soul will not be forced to go with its outer edge, in the way it had been because of being interfaced with the Present-Moment sensual body. But other than that, nothing should happen to it. The Soul is a waveform, and since it is in the Past and no longer interfaced with the source of energy that was provided by the body, it will remain as it is forever; since to change its shape would require the exchanges of energy that can only occur at the Present Moment. Since it is deprived of energy, it will remain as it is unless, or until, it again becomes interfaced with an energy source. But in the meantime, it has been, for all practical purposes, dumped into another dimension, which is the Dimension of Time.

Abandonment of the Soul in the Time Dimension.

If this is true for one Soul, it is true for all Souls; and whenever a person dies, his or her Soul is abandoned by the body and enters another dimension, which is Time. Of course, the Soul was in the Time dimension all along, but

just didn't know it because its attention had been focused on the surface of the bubble, or the Present Moment, trying to keep its symbiotic neurons out of trouble. But now its neurons have died and it is on its own, in company with all the other similarly abandoned Souls. What might these Souls look like? This is a relatively meaningless question since we are talking about another dimension where the meaning of "seeing" must be something entirely different from what we are used to. Nevertheless, considering that the Soul has two parts, the antenna part and the waveform-cuddling part, it is fun to think that the antenna part of your Soul would look just like you did, and that the waveform-cuddling part of your Soul is perhaps quite beautiful and bright, so that you appear to be surrounded by a halo of light. A casual Observer might mistake you for an angel.

The evolutionary ladder of Souls.

But I digress. What my mastiff really wants me to think about now is the advancement of Souls through the hierarchy of evolution. The evolution of the Soul must be a very long and gradual process that began with the recruitment of a waveform from the chaotic vacuum, and then proceeded, step by torturous step, up the evolutionary ladder. It is a process that would require the Soul to establish symbiotic relationships with a series of "collections of neurons;" and would thus experience many lifetimes. The Soul must begin in a humble way, associated with a humble set of neurons, and could then hopefully evolve toward better and better neurons. There is no guarantee that this will happen, but if the Soul is lucky, it will occur over time. Clearly, the set of neurons that constitute a human body is the very best set of neurons to which a Soul can aspire. For

a Soul to have finally established a symbiosis with a human body, and thereby become a human being, is a great achievement. Once this is achieved, the goal of the Soul is to try to grow in ways that enhance the likelihood that it will not slip back into the chaotic vacuum, which means that every human Soul is on a path by which it aspires to become better and better. Whether the Soul can advance on this path, and not slip back, depends on the experiences it encounters during the times that it has access to the energy of the Present Moment, and thus to change and grow. The way the Soul deals with these experiences is very important, and ultimately determines whether it will advance, or slip back into Chaos; whereupon the chances of re-emerging are small.

It is interesting to contemplate how complex a group of neurons must be in order to possess a Soul waveform. Neurons can be found in very primitive organisms, such as nematodes and flatworms. It is possible that even these humble neurons have recruited Soul waveforms to help them survive the exigencies of life. The crucial thing the Soul does is to make decisions that cause the neurons to make observations that increase their likelihood of survival. A simple organism like a bacterium lacks neurons, but nevertheless responds in a sensible way to its environment; swimming toward food and fleeing from danger. Biochemists have studied how bacteria achieve this, and found that they do it in an automaton fashion, and do not really make "decisions" that require what we think of as "judgment" Food molecules bind to receptors, and this triggers the release of metabolic energy to cause the flagellum to spin in a pre-determined direction. Swimming toward food instead of away from it is a lucky accident, but the bacterium eventually wends its way toward food by repeating this trial-and-error process in an appropriate

way. The bacterium possesses Curling energy and uses it to get food, but it does not need to consult a memory waveform in order to "decide" what to do.

A humble set of neurons could conceivably use a similar approach. In a soil-dwelling nematode, burrowing down away from sunlight might be a beneficial thing to do. A particular specialized neuron might "fire" when it is illuminated with photons, and this firing could cause the little organism to use Curling energy to twitch. There would be no "decision" whether to fire or whether to twitch, but the firing and the twitching would simply be triggered by light. If the twitch has the lucky result of burrowing deeper into the ground where the organism is protected from light, it will not twitch any more. But if it has gone the wrong direction or is still not deep enough, it will twitch again and again until the problem is resolved.

The Soul waveform can only come into its own when it is able to influence what the neurons will do by means of consulting a memory waveform, and the neurons then act in a way that is the most harmonious response to the waveform, as discovered by the waveform-cuddling Soul. The mechanism by which the neurons take action is to exert 0-forces to cause 0-motion as powered by Curling energy. This is a very high-level response and would seem to require a large number of neurons that are operating in a highly cooperative fashion. Exactly how large a number of neurons is required is hard to say.

It would appear that the crucial test of whether a collection of neurons possesses a Soul waveform that is functioning to aid in decision-making by resonances with a Past waveform is to determine whether the organism in question can form true memories and to "learn." We have to be careful when we say this, because the learning that is going on must result in a memory waveform being laid down,

and the organism must exploit these memories by means of the Soul seeking resonances within the memory waveform. The responses of the bacterium as it swims toward food appears to suggest that it has "learned" what kind of a situation it is in and is acting on this "knowledge" by "making decisions:' But this is clearly not the case, as has been established by biochemists.

If you jump up the evolutionary ladder to, say, the goldfish, you clearly have learning and memory going on that is similar to our own. The fact that biochemists use goldfish to study memory reflects this. So I guess I would have to conclude that goldfish have Souls, because they could not otherwise be sensibly utilizing the information that is stored in their memory waveforms. There is some evidence that flatworms can learn. This was from experiments reported many years ago about flatworms crawling down a path that came to a Y-shaped intersection. They were given an electric shock if they turned to the left, but not if they turned to the right. After many repetitions, the flatworms started to prefer turning to the right, as if they had learned that it was prudent to do so. It is conceivable that those experiments were poorly done, and the flatworms did not really learn anything. Another possibility is that this response is a high-level automaton response, and was not actually a decision-making process, although it appeared to be. After all, until biochemists sorted out what bacteria were really doing in their search for food, it appeared that they were making intelligent decisions.

A third possibility is that flatworms have indeed recruited Soul waveforms to help them out. If that is the case, we can see how far we have come in our climb out of the Chaos of quiescent waveforms. And we have been worried about the philosophical implications of our bodies having evolved from the bodies of apes! Now we must con-

template that each of our Souls started out as something like a flatworm Soul and wormed its way up the evolutionary ladder until it became a human being. Not that we evolved from a flatworm Soul in the way that our bodies evolved from apes; but that each of our Souls actually WAS a flatworm Soul, and that each of us actually WAS a flatworm, or something equally primitive.

I do not like this idea. I look down at my mastiff, and he is on his back again, waving his paws joyously in the air and grinning. Oh, well. Most of us have gotten used to the idea that our bodies evolved out of the primal ooze. Now we may have to get used to the idea that our Souls did, too.

The idea that we have crawled up an evolutionary ladder of Souls is something to think more deeply about. Any symbiotic relationship always requires that each participant in the symbiosis be highly adapted to the other. This suggests that the Soul of a grasshopper would not be a good symbiotic partner to the body of a lobster. Nor would the Soul of a lobster be a good symbiotic partner to the body of a goldfish, nor the goldfish Soul to the body of a rabbit. Fortunately, the ladder of biological evolution provides a ladder for the evolution of the Soul, and a Soul that has established a successful symbiosis in one species can evolve by jumping to the species that is next up the ladder of biological evolution.

This means that the logical reservoir of Souls into the human species is the non-human primates, and that there are probably some people walking around whose immediately prior life was as a non-human primate. This is in no way a put-down. To enter the pool of human Souls is the culmination of, probably, a billion years or so of successful climbing up the evolutionary ladder of Souls. It is as if you are talking about an honors freshman at Harvard sharing classes with the juniors and seniors. Although the fresh-

man may not be able to perform as well as the seniors during her first semester, the fact that she was admitted into the freshman honors program at Harvard allows one to have confidence that she will rise to become equal to the best of them once she has become adjusted. So, too, with a new recruit to the pool of human Souls.

The Harvard seniors understand that the Harvard freshmen are a pretty clever lot, and treat them accordingly. To do otherwise would be shooting themselves in the foot, because their ultimate success in life depends much on the quality of education they get in college, and if they degrade that education by impeding the progress of the new recruits, they themselves will end up the losers. The Harvard seniors understand how the system works, and this is a big help in informing them how to behave. We do not have this advantage with respect to the ladder of the evolution of Souls, and our behavior shows this.

This line of thinking suggests that there is some kind of social structure among the Souls in the Time Dimension. Just as we humans set ourselves apart from all the other creatures on the planet and largely let them go about their own business of food-gathering, breeding, and so on, the human Souls in the Time Dimension may likewise consider themselves apart from the rest. We cannot imagine what kind of 'existence' they would have because we cannot conceive of existence in another dimension. Although one must exercise extreme caution, we can perhaps gain some insight as to what it is like there by returnees from Near Death Experiences. Many report seeing loved ones and lovely places like gardens filled with beautiful flowers. Despite being consigned to waveforms that cannot change without access to energy, there may be other considerations that permit moving around and interacting with other Souls. Motion and interacting could be by completely dif-

ferent means than we are used to, but we can perhaps nevertheless avail ourselves of them. Perhaps the human Souls have figured out how to make the Time Dimension into a truly lovely place. A heavenly place.

So why would they worry about us, trapped in the bubble surface of the Present Moment? And why did those Souls that are now trapped in the bubble surface of the Present Moment agree to leave the Time Dimension and "come to Earth"?

This may be a very complex question that we can only guess about while we are trapped here, insensate with respect to our prior origins. We are insensate with respect to our former lives because as the body dies and the Soul is released to drift in the Dimension of Time, it drifts away from the memory waveform of the body that it was associated with. And when it establishes a symbiotic relationship with a new body, a new memory waveform is built, and that new waveform is then the only memory waveform to which the Soul has access. There may be some other kind of memory that the Soul can access when drifting in the Time Dimension, but while immersed in the intensity of the Present Moment, the Soul must focus on its current memory waveform, since it has become physically detached from its prior memory waveforms.

It is probable that there is an inner need for Souls to improve themselves, and the only way to do that is to venture forth in a symbiotic relationship with a body, where the energy to allow the Soul to change and evolve is available. Perhaps there is some process by which the ways your Soul needs to improve are decided, and you are tossed into a life that is suited to impose these improvements. Maybe you can participate in the decision. If you are having a tough life, maybe it is because it was decided that you would benefit from it, and maybe you couldn't think of a

good argument against it, so here you are in the tough life that you need in order for your Soul to improve.

It is clear that you can in no way fake the quality of your Soul, since the way you lived your former lives is a matter of record for all to see. No matter what protestations of honorable qualities you might provide while in the Time Dimension, when you go out into the Present Moment to prove yourself, you may perform dishonorable and evil deeds. When such a Soul returned to the Time Dimension, it might be quite grieved and contrite at what it had done; for it would have revealed for all to see that its moral foundation was weak. One can imagine that the other human Souls would say, "What a sleaze-ball you are. You were sent out to be a king's son. And when you grew up, did you lead the people toward righteousness and wisdom? No, you went out and fought battles for your own glory and plundered the wealth and raped the women. You had this terrific opportunity, and you absolutely blew it. When you go back next time, you should be a helpless cripple. Or maybe a cockroach." The latter is an obvious joke, since a human Soul could never establish symbiosis with a cockroach brain to produce a memory waveform that would function in a cockroach. At least not until it had fallen back through the evolutionary hierarchy of organisms until it finally reached the cockroach. You can climb up, and you can fall back down. Presumably all the way back to the Chaos from which you had come, if you're not careful.

On the other hand, if you were sent out to a material life that was one of difficult and trying circumstances, but you pushed these unsavory influences aside and lived a life that was positive and a good example to others around you, when you went back you would be accorded high status accompanied by admiration and respect. A Soul that went out again and again, and each time performed good

works, would prove to all that it was of the highest moral character. Since it is a goal of all to strive toward becoming a better Soul and to resist the tendency to slip back toward Chaos, such good Souls would have a responsibility to extend a helping hand to other Souls who were struggling while in the Present Moment. After all, even Harvard honors students struggle with the challenges they meet and can't always successfully cope with them unless they are properly mentored. The good Souls can perform this mentoring by being good teachers, leaders, and role-models while they are living in material bodies, in the Present Moment.

If it is so that there are human beings whose Souls have recently evolved to become human, then there must be others that have been human for a long time. How long is long? Until very modern times, a human was lucky to live forty years, so one could squeeze in maybe twenty lifetimes per millennium. People lived in caves thirty thousand years ago, a span which could encompass 600 lifetimes between then and now. Souls would not necessarily immediately venture back out upon the deaths of their symbiotic partners, so there would probably be fewer lives actually involved over this time. Since there were certainly cave people living thirty thousand years ago, their Souls must mingle among us. The human population appears to have hovered at no more than a million up through the cave days, so the proportion of Souls that have persisted in human form since then must be quite small, since we now have a population of over five billion humans, which is a five-thousand-fold increase.

Maybe one of the reasons why the world is in a mess is because the pool of human Souls is full of newcomers that haven't yet learned the ropes. It is as if the freshman class at Harvard suddenly swelled up to be five thousand times

larger than its senior class. You can imagine what effect this would have on the respect that is paid to great old Harvard traditions. Simply because there are not enough seniors to go around, the freshmen have to take over leadership roles and start deciding where Harvard should be going in the future. They are bound to make big mistakes. The only hope is that they are, after all, Harvard students, and have the stuff it takes to do things properly if they can just get their act together. The problem is that the world has become such a powder keg that we may not be able to wait a few dozen lifetimes so that the human freshmen can learn to key in on the wisdom of the ages.

A Contemplation of Consciousness.

One thing I have neglected in considering the evolutionary path that the Soul takes from the state of chaos to becoming human, is the role of consciousness. The nature of human consciousness has baffled philosophers and scientists, but my mastiff has dragged me to places that suggest answers as to what consciousness is.

Current thinking among scientists is that the brain is an extremely complex computer with lots and lots of interconnections, and that this sheer complexity somehow kindles the conscious state. Except for the fact that the brain is a resonator instead of a computer, this seems to be a reasonable idea; so let's develop it. Earlier, we thought about the simplest kind of creature that could possess a Soul and concluded that it was one that had neurons, and probably a fairly complex set of neurons. A flatworm can perhaps fulfill these requirements, so let's suppose a flatworm has recruited a Soul waveform to help it make decisions about which directions to crawl. Surely this flatworm is not con-

conscious in the sense that we are conscious. Since we are conscious, then consciousness is a state that is acquired at some point along the evolutionary ladder, and when the Soul reaches that point in its climb up the ladder, going from one symbiotic partner to the next, it will suddenly become conscious. This argues that consciousness is, indeed, a consequence of the increased complexity of the symbiotic Soul-neuron system, and that once this critical level of complexity is attained, further steps up the ladder will also have consciousness as an attribute. It is pointless to debate about which stage along the evolutionary path-way that consciousness sets in. Probably all the vertebrates are conscious, but perhaps many invertebrates such as insects and mollusks are not.

So exactly what is consciousness? For the answer, we have to turn as usual to the fact that everything is observations and waveforms. As I sit here in my conscious state, I have a storm of input from my senses, and my neurons resonate with this input. Not only are my neurons resonating, but they are putting energy into the resonating waveforms of the objects that surround me, thus intensifying the Reality of their existence. This creates a resonating system that is driven by the energy of my neurons, and the intensified Reality of the surrounding objects will cause a more intense resonance within my neurons. This constitutes a mutually reinforcing resonating system, in which the energy of the neuron drives the waveform of what it observes, and the energy of the observed waveform feeds back to reinforce the resonant energy of the neuron. Thus, the resonating system will increase its energy content more and more, to level off at a maximum that is dictated by the amount of metabolic energy that is available to the neurons.

This back-and-forth intensification constitutes a feed-

back loop and is the kind of thing that happens in the sound system of an auditorium, when someone taps the microphone to see if it is working. The tap on the microphone is amplified by the sound system, and the sound of the tap goes out through the speaker system to be picked up again by the microphone. If the engineer has set the amplifier to a high level of gain, the sound of the tap will be picked up by the microphone to be amplified again, and put out through the speaker again. When it comes out the speaker this time, it is even louder, so the microphone picks it up even better. The auditorium is suddenly filled with a loud squeal as the sound of the microphone tap goes round and round this feed-back loop, getting louder and louder. It levels off at an intensity that is limited by the power available to the amplifier system. The sound engineer scrambles to turn the amplifier down, and the squeal dies away.

It appears that consciousness is the biological equivalent of the squeal produced by a sound system that is in a state of feed-back. An organism with a relatively simple set of neurons does not impose sufficient intensification of Reality to set off the feedback loop, so it is unconscious; even though it has neurons, makes observations, and has a Soul to make decisions that influence what the organism will do with its body. But as you go up the evolutionary ladder, organisms become increasingly complex, and their neurons increase in number and become highly interconnected, and they specialize in intensification of different aspects of their surroundings. Our hearing neurons intensify the Reality of sounds, our touch neurons intensify the Reality of those things that touch us, our eyes intensify the Reality of those things that we see, and so on.

There comes a point in evolution when the sensory input and resonant output of the neurons is powerful enough to set off a feedback loop, just as slowly turning up

the gain of the amplifier in the auditorium will, at some point, cause a feedback squeal even if you don't tap the microphone. Ambient noise alone will do it. When this feedback loop is set off in an organism, it becomes conscious. This explains why we lose consciousness when our body is flooded with an anesthetic. The anesthetic interferes with the ability of our neurons to resonate, and the feedback loop is broken just as the squeal stops when you turn the amplifier down. A blow to the head also disrupts neuronal resonance, and we lapse into unconsciousness until it is restored. When we go to sleep, our senses become dulled to our surroundings, and our consciousness is dimmed.

Consciousness is obviously of enormous survival value, and once the complexity of organisms increased to the point to where consciousness could be sustained, there was great selective pressure to retain it. Consciousness has the effect of totally integrating our sensory input, so that our resonant responses can be determined by this totality of input. Consciousness is both cause and effect. It is caused by the complexity of sensory input, and its effect is to integrate all the sensory input into a seamless whole. Because of all the interconnections of neurons, it is as if our entire body consists of a single neuron, and everything we do is an integrated resonant response of this single neuron. This is why, in the conscious state, we are totally aware of our surroundings. At any instant, we are seeing, hearing, smelling, feeling, touching; and our consciousness integrates the totality of this input into a single merged waveform that is our total experience of the Present Moment. We resonate with this total experience. We feel happy, or sad, or contented, or flustered. This experience, including our interpretations of it, is laid down in the resonant memory waveform of our brain, to be utilized another day.

Encounters with the Time Dimension

I feel relaxed as I come to the conclusion of this resonant pathway. Although there were some scary moments during the ride, the end of it turned out to be fairly pleasant. I look down, and I find that my mastiff is asleep. It is a relief that he won't be dragging me anywhere else for a while. I'm sure if I tried to sneak away, he would jump up with a growl and drag me back. So I settle down in my chair and relax. My mind begins to drift, which makes me a little nervous. I have gotten so used to being dragged hither and yon by my mastiff, that I don't know what it would be like to wander around on my own. When my mastiff was in charge, the idea of Souls that dwell in the Dimension of Time and live multiple lives and struggle to escape the Chaos, seemed very serious. But now that my mastiff is asleep, they seem a bit comical.

I wonder about the relationships between the Time dwellers and the Present Moment dwellers. Clearly, the Present Moment dwellers do not have a clue that the Time dwellers exist. But the Time dwellers know all about the Present Moment dwellers, and probably become frustrated with how they behave. Since the Time dwellers have access to the big picture, they are better situated to assess how things are, and where we are all going. They have surely figured everything out about the evolution of Souls, and the symbiotic relationship between the Soul and the body. They long ago came to understand the crucial role of observations in the nature of the universe, and that the Present Moment dwellers are Observers, and that their observations are crucial to the Future of the universe. The Time dwellers are undoubtedly frustrated that when they venture out and become Present Moment dwellers, that their cognizance of these things is suspended until they return

to the Time Dimension, and while they are in the Present Moment, do some pretty stupid things. Things that if carried too far would destroy the entire system of the cycle of Souls. For example, if the world got into wars and all of the Present Moment dwellers were killed, the Time dwellers would no longer have access to the Present Moment, and their Souls would cease to be able to evolve. They therefore have considerable stake in things keeping on an even keel, and if they veer out of control, they would try to steer things back.

If things are going reasonably well, they can relax and let the physical laws of the universe push things in the proper direction. However, from time to time, things might take a really nasty turn in the Present Moment, and it might be deemed necessary to take some kind of intervention. The means available to do so must be quite few, and those that are available are quite indirect; since the Time dwellers do not have access to the energy that is required to shape events in the Present Moment. But one thing they can do is to send Souls out into the Present Moment where they can shape events. Since every Soul that enters the Present Moment suspends all notions associated with the Time Dimension, the only way to guide what happens in the Present Moment is to choose Souls that have a history of doing the right thing at the right time. Good Souls. If a suitable Soul is introduced into suitable circumstances, it could develop into a charismatic leader who could provide the teaching and guidance that is necessary to turn events in a favorable direction. If things are really bad, the charismatic leader needs to be really good.

The Time dwellers would plot and plan about ways to do this. The big questions would be, exactly which Soul should go, and what material body should be chosen for its destination? You certainly wouldn't want to choose the

sleaze-ball Soul that had plundered and raped when sent back as a king's son. You would want to turn to Souls that had the very best records, and there should be one Soul that is particularly distinguished among all the others.

That would be the first Soul that had advanced up the ladder of evolution and reached consciousness. Imagine the plight of that first conscious Soul. Whereas it had already lived many lifetimes, it had not been aware of them because it had not been conscious. But then the day came when it joined with a symbiotic partner that had evolved to sufficient neuronal complexity that the conscious state was kindled. That Soul would have then lived a life in which it was "aware" for the first time. But eventually, the day came that the symbiotic partner of the Soul died, and the Soul was left stranded and alone in the Time Dimension. Perhaps it was terrified, and wandered aimlessly among the Past waveforms. Filled with terror and perhaps despair, it was in great danger of falling back down into the Chaos from which it had painfully crawled. But it eventually sought another symbiotic partner and would naturally choose one whose complexity was comparable to the one that had kindled consciousness. So it continued in a conscious state. One can only wonder how long this lasted, and how many lives that first conscious Soul lived alone. It had to develop superb qualities in order to survive the adversity of its existence, to grow in a good direction, and against all odds, to become a Good Soul.

Eventually, other Souls also established symbiosis with bodies that were sufficiently complex to support consciousness. They, too, would have been in a state of terror and despair when their bodies died. They would have all slipped back into Chaos, except for the Good Soul that extended a helping hand. (S)he reached out and touched them, quieted their terror and despair, and showed them

that love existed. They responded with trust and gratitude and proceeded to learn from the Good Soul about how to properly live their lives, both while in the Time Dimension, and in the Present Moment.

If things were going really badly in the Present-Moment world, it is this Good Soul that you would want to send out to try and lead the lesser Souls out of the darkness into which they have gotten themselves. And if that Soul didn't want to go, then you would want to choose the Soul that was second best, which would probably be the first one that the Good Soul had helped and mentored. They would be a little like Father and Son.

So, a time came when the Present-Moment world was experiencing great problems, and it was determined by the Time-Dwellers that intervention was necessary. We all know the story here. The Father decided to mind the store in the Time Dimension, and to send out his Son instead. It was decided that the Son should be born as a male under humble circumstances, probably to insulate him from the corrupting influences of wealth and power. Other Souls with superb credentials of having lived exemplary lives were sent to provide as much assistance as possible. There was an advance team consisting of a mother and father, as well as relatives and friends. These would provide the nurturing environment to permit the latent noble attitudes of the Jesus child to flower to their greatest possible extent. As he grew up, Jesus sensed that he was living under unusual circumstances, and that his family and friends were rather different from the sleazy people he ran into during his increasing wanderings. During these wanderings, he encountered at least a dozen individuals who seemed particularly eager to accompany him and help him in whatever way they could. Although one of the dozen turned out to be a sleaze-ball Soul, the others were a terrific lot that fulfilled

the expectations that had led to their selection from among the Time-Dwellers to help Jesus perform his role of teaching the Present-Moment dwellers how they should live.

Perhaps the inhabitants of the Time Dimension can influence a Soul that is in the Present Moment in subtle ways, particularly during sleep when the bombardment by our senses is quieted. One can see how the nurturing environment of his childhood, which helped Jesus establish a suitable memory waveform; the aid of many good Souls who shared his life, and perhaps whispering dreams from the Time Dimension permitted Jesus to achieve what he achieved.

He brought a message that was spoken in riddles. He was sent by the Father, but was the Son of Man. In order to reach the Kingdom of Heaven, you must be born again. All would have everlasting life, and our bodies eternal existence. These and many other riddles were merely reflections of the Time Dimension and the relationships of all Souls with it.

It was exactly what was needed. He lived the perfect example of a righteous life and taught ideas of morality through simple stories that reached people's hearts. He set down an explicit moral code that would help return humankind toward the direction of stability and continuity. Perhaps because everyone derives from the Time Dimension, his message resonated to give people hope that there is more to come beyond the temporal lives we are living, that there is a reason to live a righteous life, and that the reward for doing so will come at some time and in some place.

Now that we can include the Time Dimension in our understanding, we can resolve the paradox that Jesus is both divine and human, and we see that all of us possess these same elements. The thing that sets Jesus apart is a

matter of degree, because he is the Son of the Father. Because Jesus proceeded up the Ladder of Souls long before the rest of us, he will remain forever exalted among us. But we can aspire toward his qualities by following his shining example. During the billions of years before us, each of us will move from the Time Dimension to become interfaced with the Present Moment countless times. If we imbue these temporal existences with noble purpose and good works so that our Souls can evolve in beneficial ways, we can aspire to come ever closer to what Jesus is. But of course, no matter how close we come, the difference between what we are and what he is will never vanish, and he will remain forever exalted; just as the Father will remain forever exalted over him.

We know the events of Jesus' life because four Souls were sent to chronicle his achievements and to write them down under circumstances that were destined to accord them with the highest authority. Indeed, it is appropriate to accord the Gospels with this authority, because they teach the lessons that the Father learned during the most trying of circumstances and were passed on to his Son with great love. The fact that these teachings have persisted to the present day shows what an effective tactical success this operation was.

The Garden of Eden and the Lesson of the Climber.

Now that we are engaged with Biblical issues, it is illuminating to look at the myth of the Garden of Eden from the perspective of the Time Dimension. Perhaps the Garden is an impressionistic reflection of human existence from long ago, when there was more interaction between Time-Dwellers and Present-Moment Dwellers. Rudiments of the

purpose of human existence may have been communicated by the Time-Dwellers through dreams, and the Present-Moment Dwellers may have sustained these ideas through legends. There may have been a comfortable oneness in which the temporal Souls were given guidance and succor in the meeting of all material needs. This would have been a very comfortable existence.

However, suppose it is true that the real purpose of human existence involves shaping the destiny of the universe, and when it comes time for us to do this, it will require the participation of myriad Present-Moment Souls united in common purpose throughout the universe. We could not achieve this Destiny while simply wandering around in material and emotional comfort, with no clue about this purpose. After all, there will come a day when a comet will strike the earth or the sun will explode, and this pattern of life would be extinguished. Although it is very enjoyable, it cannot lead to the fulfillment of our purpose, which apparently includes our learning how to inhabit the greater universe. When we are Time Dwellers, we may know exactly how to do this, but it must be impossible to explicitly communicate this to the Present Moment Dwellers. Moreover, when we move from the Time Dimension to the Present Moment, we are shorn of all explicit knowledge of our origins, retaining only shadowy impressions; so while we are here, we have to learn by pulling ourselves up by our bootstraps. Perhaps the Time Dwellers can help a little bit and can influence the decisions of creatures whose minds are undecided about what to do. Suppose there is a camel wandering in the desert. It may be enjoying itself and its mind is clear. Since there is food in every direction, it simply doesn't matter if the camel turns to the right or to the left. So the merest whisper from a Time Dweller sends it to the left instead of the right, and it wan-

ders forward in the new direction. More whispers, and more wanderings, and it isn't long before the camel wanders into a camp of hungry Present-Moment dwellers to offer itself as dinner. Maybe we are similarly guided when our minds are clear and open to suggestion. If we "tune in" to these suggestions, perhaps they can guide us in the acquisition of the knowledge we need in order to live useful lives and to fulfill our destiny.

Unfortunately, the way of life that permits the discovery of this knowledge is incompatible with the way that life was enjoyed in the Garden of Eden, or perhaps still being enjoyed among tiny tribes of aboriginal peoples. Some of us must have agreed to abandon that wonderful life and to embark on a lonely quest toward discovery of the Knowledge that we need in order to fulfill our Destiny. We would have done this many thousands of years and many lives ago. It must have been a very difficult step to take, one that we would not have taken had it not been absolutely necessary. Imagine how a Soul from the perspective of the Time Dimension would feel about entering the Present-Moment world without the Soul-nourishing sense of Oneness with other Souls and all of Nature? To not know that all your needs would be met at the proper time as long as you remained true to yourself and attentive to Nature's ways. To not know that if you were hurt, you would be healed. To not know that your pain would always be soothed by loving comfort. To not know that you would be loved and accepted and admired and appreciated for your skills and talents, no matter who you are. To instead be cast into a world filled with doubt and fear. And loneliness. With no sense of purpose or reason for being. To be cast out of the Garden. So completely cast out that you no longer know who you are and must try to make sense of things as you go along. Never knowing what danger lurked around the next

bend. Never knowing if you would find food that day. Never knowing what you would do if you were hurt or sick. Never knowing if someone could or would love you.

But it simply had to be done, so we did it. We built an entire civilization around the quest for this Knowledge. Perhaps the Tree of Knowledge is a metaphor for the long road that must be traveled in order to gain the Knowledge required for us to fulfill our Destiny. The road has many branches, and each branch must be found and traveled in order to attain its fruit. It is only after we have traveled every twig and leaf and sampled every piece of fruit on the Tree of Knowledge that we will understand what it is that we need to do, and how to do it. One can only hope that after we attain this understanding, and proceed toward fulfilling this purpose, that we can once again coalesce into a state of oneness among ourselves and with all things.

Traveling the road out of the Valley of Ignorance in search of Knowledge has been very difficult. Perhaps we are like someone who has just spent a lifetime climbing out of the valley of the Grand Canyon. Every step was an effort to find foot-holds and hand-holds, with every thought focused on the details of the torturous climb. And then he gets to the top. You can see the hands grabbing the top edge of the canyon wall, and with great effort pulling his body up, then laboriously placing a knee on the top edge. Then pulling and pushing with every ounce of strength and concentrated effort. Total sense of purpose to the goal. The second leg goes up. A grab for a new hand-hold. A precarious slipping back, followed by more intense concentration and renewed purpose. Finally, every bit of strength drained, a new hand-hold, and one last pull. The gasping creature has finally reached the top! For a few minutes, he lies there, his head buried in his arms, reveling in the triumph of the successful climb. A job well done!

Then, slowly, he raises his head and begins to look around. Everything is different. There is no more canyon wall to climb. Suddenly, there is a crisis of purpose in his mind. All he had ever known was the climb. His only purpose up to that moment was to climb. There was never any need to think of anything else. One wouldn't want to, since it could distract and thus destroy. But what next? The old purpose is now meaningless in the face of this new terrain. Does that mean there is no purpose and there never was? He looks around and sees food in abundance. He sees shade under a nearby tree. Is that the purpose? Is the purpose of the climb so he can relax and live off the abundance of the earth, in peace and contentment forever more? It looks attractive, but he is somehow disappointed. He was hoping there would be something more. A new challenge. A challenge much more meaningful, much more important, much more worth doing than just climbing up the cliff of Knowledge, and then using that Knowledge for an easy life.

Then, he looks up and sees the stars. He had seen them before, of course, during his climb. They were a comfort in their beauty and myriad designs. But now he sees them differently. A thought vaguely coalesces in his mind. Perhaps they are part of the new challenge. But are not an end in themselves. The real challenge is not to go to the stars. But to know *why* we should go to the stars, and what we should do when we get there.

Part IV
The Future of Observation

My mastiff has dragged me past vistas that I have been astonished to see. If these vistas are real, then the path of human destiny is going to be far different than I would have ever imagined. When I asked my mastiff whether he could show me vistas of the Future, he sat down hard on his haunches, lowered his head, and growled. I then asked if he could help me think about what the Future might be like, and he stood up and wagged his tail. That grin again.

UFOs and Aliens.

One evening, I sat dozing in my chair in front of the television set. The show I had been watching was over, and something else came on that I had no desire to see. So I dozed off. Suddenly, my mastiff bit my ankle and gave a sharp bark, and I was startled awake. There in front of me was a kind of television program I seldom watch, because such programs are so ridiculous. It was about UFOs and aliens. It's not that I have anything against aliens, just against these TV shows. They are so sensationalized and filled with stuff that is obviously made up.

Apparently my mastiff wanted me to think about aliens. So I thought about aliens from his point of view. First of all, aliens must surely exist. The Force toward Reality is universal, and would cause life to evolve and develop neurons wherever conditions are suitable. Cosmologists argue that there are millions of planets in the universe that are sufficiently earth-like that they could support life, so they probably do. Many of these would have evolved intelligent Observers that would develop the capability to observe the creation of the universe, just as we are doing. They would divine their purpose in the universe as

Observers that would help shape the Future of the universe so that it could attain its ultimate conclusion, whatever that is. Life could evolve in different parts of the universe at different times, so there may be Observers that have lived many more lifetimes than we have, and have gathered much more wisdom than we have.

A conundrum that has recently been unearthed by astronomers and cosmologists is that some parts of the universe appear to be much older than other parts. One way to explain this disparity is that when life begins in a particular part of the universe, it intensifies the Reality of objects around it, causing heavenly bodies to organize themselves around it, just like an oasis in the desert organizes itself around a source of water. If life started at one place earlier than at another place, then the region of space that surrounded this life would consist of older heavenly bodies than those in regions of space surrounding life that started later. Even though the universe as a whole may be of a single age, having started at the Big Bang, astronomical investigation of the different parts of the universe would suggest that it is of several different ages. The apparent discrepancies in age that astronomers are seeing is of the order of several billions of years, which means that there are probably Observers that have existed in some parts of the universe for billions of years longer than we have. Surely they know many things that we do not.

One of the things they surely know about is the relationship between the body and the Soul, and that the Soul exists in the Time Dimension. If they have known this for billions of years, then they have probably figured out how to establish facile communication links between Souls in the Time Dimension and Souls that are enmeshed in the Present Moment. Perhaps they have even learned how to disengage a Soul from the Present Moment and let it enter

the Time Dimension and then return to the Present Moment.

They would have developed a keen sense of their place in the hierarchy of biological and Soul evolution, and the fragility and vulnerability of their biological symbiotic partners. If the aliens wished to increase their numbers, they would have to be careful to maintain the ladder of biological evolution to allow a path for Souls to climb from lower forms to "human" forms. They would treasure each species as a reservoir of Souls. The aliens would live each of their lives in the Present Moment in a way that would enhance their subsequent lives in the Present Moment. They would be especially careful not to defile their planet, because after all, they would be back and they would not want to come back to a cesspool. They would be particularly loving and nurturing of their children, just as they will want to be loved and nurtured when they return in their future lives. They would go to great lengths to wipe out pockets of poverty and despair, where people lived in a state of degradation and hopelessness. If they failed in this, there was a good chance that they would find themselves cast into this state in a later life, and thus put their Souls at risk of sliding back into Chaos.

They would also realize that they must colonize new planets, and populate them with all the species that comprise the ladder of biological and Soul evolution. If they did not, the day would eventually come when their sun exploded or their planet would be destroyed by a comet, and all living creatures on their planet would perish. The Souls of the aliens, however, would never perish because they are eternal just as ours are; and would exist forever in the Time Dimension. But the destruction of the ladder of evolution would mean that they would forever lose access to the Present Moment, since at their advanced state of Soul

evolution, they would be highly adapted to the symbiotic body of their "human" form, and once all these are killed off, nothing else will serve.

Perhaps such Souls could exist in a state of contentment in the Time Dimension. But they would have lost all opportunity to improve their Souls by living the Time-Dimension lives that give their Souls access to the energy needed to grow and evolve. Not only that, but they would also forever lose the ability to participate in the Destiny of the universe. Such aliens would only wonder at their own stupidity in not caring for their planet and all the creatures in it, and being so unthinking about planning for the Future. After all, the Future is Eternity, and that is a long time to be forced to ponder your mistakes.

I sense that I am going down a resonant pathway, with one thought leading inexorably to the next. So that is why we humans are fascinated with the exploration of space! We should congratulate ourselves on sensing that it is our destiny to leave the earth. It is vital that we succeed in doing so before the earth is destroyed by a comet or the death of the sun, otherwise we will not be able to complete our greater purpose, which is to guide the universe to its proper Destiny. The problem is that, while we know what we are doing, we do not know why we are doing it. It is a big drain on the resources of human society to build rocket ships, especially ones that can carry people. And now we are talking about some kind of ark that will carry all the animals too, just like Noah. It is very difficult to justify the expense of such an enormous undertaking just because we are scientifically curious. It is surprising how far we have come on this flimsy argument, and the fact that we have swallowed it shows how deep is our innate desire to carry out this Destiny, and that we will grasp at anything to justify doing it. Once we realize what we are really doing, and

what our Destiny really is, we can put our shoulders to the wheel and get the job done without having everyone jumping up and down and complaining that they would rather have a fancy car to drive, and a vacation home at the beach. Once we realize what is at stake, we will pursue it with determination. That is the way of Observers.

I looked down at my mastiff, and he was grinning again. But suddenly he gave another sharp bark and bit me on the ankle again. My attention turned back to the TV set, where the show on aliens was still going on. Here was a part on alien abductions. Although most reports of abductions are surely bogus, it is possible that a few are real. It is curious that whenever anyone reports being abducted by aliens, the aliens always seem to have a perverted interest in their reproductive organs. Perhaps there is a reason for this. Suppose that something has happened to the alien's planet, or their biological evolution took an unfortunate turn resulting in poor viability. Since the symbiotic relationship between a body and a Soul is highly evolved and very specific, if their biological population were to die out, then their Souls would be forever trapped in the Time Dimension. Their only hope would be to breed a new type of body that could establish a symbiotic relationship with their Souls, and this could conceivably be some kind of human-alien hybrid. This would require highly-advanced genetic techniques and human genetic material. Time may be running out for them, and they are desperate. Poor Souls.

This thought is interrupted by another sharp bark and bite on the ankle. My attention returns to the TV set. Now they are talking about UFO sightings. I watch and listen to these for a while. Most of them seem bogus, and fall into two categories. One category is that someone has seen something ordinary, like the Goodyear blimp with the sun

shining off it in a weird way, or the planet Venus on a clear night, and mistakenly concluded that it was a UFO because they did not recognize what they were seeing. Another category is the lies and hoaxes, where people do things like take pictures of model flying saucers and try to pass them off as real, or just outright make up lies about seeing a UFO when they have actually seen nothing at all and know it. There are so many of these mistakes and lies, that one suspects that there are few, if any, real UFO sightings.

But as I sat watching these reports, there was one kind of report that seemed to be in a different category; perhaps a category that represents real sightings. It is a kind of report that describes one or more UFOs at some distance away. Perhaps they are hovering. Then they suddenly dart off to the left, and then stop instantaneously. And then dart off to the right, and again stop instantaneously. And then they suddenly depart at tremendous speed and disappear. The curious thing is that these UFOs do not seem to be subject to Newton's Laws of Inertia and Conservation of Momentum. We cannot conceive of a way that a big space ship could suddenly just zip off at high speed without having to gather speed slowly. Nor a way that it can stop instantly or make a perfect right-angle turn at high speed without pasting all the occupants inside against the walls. The fact that there is no conceivable way that this could be done, argues that the report is either a mistaken observation or a lie.

But wait a minute. If an honest person were making a mistake of interpretation that the Goodyear blimp is a UFO, that honest person would see the UFO doing only those things that the Goodyear blimp can do, and suddenly taking off at high speed and making abrupt right-angle turns are not among them. So it is hard to see how honest but mistaken observations would produce reports of objects

that do impossible things. This means that a report of a UFO that performs perfect right-angle turns at high speed is not one that has resulted from an honest Observer making a mistake in interpretation.

This leaves us with the lies and hoaxes as responsible for this kind of report. If I were going to make up a lie about seeing a UFO and wanted people to believe it, the last thing I would want to do would be to say that the UFO did things that are impossible. I might choose to say things that are impressive, such as the UFO was big and bright and was flashing with colored lights, and that there were alien beings looking out the windows. People could believe these things if you just tell your story in a sufficiently convincing manner, with lots of corroborative detail. But if you were to start talking about how this big, galumphing UFO suddenly darted off without so much as a rev of the engines and a gathering of speed, and that as it flashed out of sight it made a startling high-speed right angle turn, your audience would roll up their eyes and walk away shaking their heads. No, you would definitely not want to include such things in a lie that you hoped would be convincing.

This argues that the sightings of UFOs doing these impossible things are made by honest Observers reporting honestly what they saw. On the one hand, we can reject this whole thing as getting nowhere, because the impossible is not possible. But there is another option, which is that this kind of behavior by a spaceship is not impossible, and that it is possible for aliens to do these things because they understand the laws of the universe that we do not. We hate to think this way, because it suggests that we have an incredibly long way to go before we can really understand how the universe works.

Catalysis of the chemical reaction of motion.

I look down and my mastiff, and he is staring at me deeply in the eyes. Although he cannot speak, it seems as if he is telling me that I already know the answer, and it is written down in the pages that precede this one. I let my mind drift back to Part II, where the Physics of Observation was developed. I think about motion, and what it is. Suddenly, I see the answer, and it is so simple! It is because motion is a chemical reaction, and an object moves from one position to the next by a process in which the energy in the waveform at the current position is pushed over a potential energy barrier and is dumped into the adjacent quiescent waveform.

In order to see this answer, it is necessary to think some more about chemical reactions, and the potential energy barrier that separates reactant waveforms from product waveforms, and the activation energy that is required to get the reactant waveform to go over the energy barrier and become a product waveform.

Imagine a box that is standing on a completely frictionless surface. You begin to push against the box, but despite the fact that it is on a frictionless surface, you must push fairly hard to get it to start moving, especially if it is a heavy box. Since we now realize that motion is a chemical reaction, we know that this tendency to stay in place, or inertia, results from the fact that we have to put activation energy into the box in order to get it over the energy barrier that separates it from the reaction product, which is the box in a new location. As you push on the box, what you are doing is distorting its waveform so that it approaches the transition state at the top of the energy barrier. The resistance you feel is due to the stiffness of the box waveform, which is caused by its mass. As you continue to push, you

are steadily distorting the box waveform, putting activation energy into it and raising it to the transition state. Now assume that the box waveform has become distorted to the point that it is exquisitely poised at the transition state, at the top of the energy barrier. Just a teensy little push, and the mass and energy of the transition-state waveform will spill into an adjacent quiescent waveform, and when it does, it will have "moved!"

Let us now review the question of which adjacent quiescent waveform will be chosen to receive the mass and energy of the transition state. Remember that there is a multitude of quiescent waveforms, and that only one will be chosen. The quiescent waveform that will be chosen is the one that resonates perfectly with the distorted waveform of the transition state that has just gone over the top of the energy barrier and has just started to go down the other side to product. The quiescent waveform that resonates perfectly with this just-past-the-transition-state waveform is the one that is identical to the just-past-the-transition-state waveform in every detail, atom for atom; including the fact that it is distorted into the just-past-the-transition-state shape. Thus, when the motion has been completed and the box is now located at its new location, the box is still poised in its just-past-the-transition-state condition. So it will immediately do the same thing over again, and spill its energy into the next adjacent quiescent waveform. And after it has done this, the box is still poised in its just-past-the-transition-state condition, so it will do it again. As long as the box is on a frictionless surface and there is nothing to soak up the activation energy that we have put into distorting the waveform to the transition state, the process will go on forever, and the box will slide forever. The activation energy required to overcome inertia is now momentum.

Now that we have analyzed this process closely, let's

think about 0-forces and 0-motion. Recall that the process by which our neurons get our arm to move is to intensify the Reality of the waveforms of those contracted muscle cells that result in the arm being shifted in the direction that our neurons want the arm to go. A neuron is able to do this only to the muscle cell in which it is embedded, because it can only achieve sufficient intensification of Reality on waveforms that are at very close range.

I will now propose that the movement of the muscle cell to its contracted shape is catalyzed by the 0-force that is exerted by the neuron. This 0-force catalyzed motion triggers the directed release of the Curling energy in the muscles, and the muscles then move the arm using this Curling energy. The 0-force is what decides what path the arm will take, and the Curling energy drives the arm along this chosen path.

I use the word "catalyzed" in the way a chemist would. Chemists have studied transition states of chemical reactions a great deal, and understand them very well. Any chemical reaction can be speeded up by supplying heat, and the speeding up is caused by the heat providing the activation energy to go up and over the transition-state energy barrier. But chemists, and Nature as well, have discovered that chemical reactions can also be accelerated by using catalysts. Nature's catalysts are the enzymes, which mediate all the chemical reactions that occur in our bodies. Chemists have developed less sophisticated catalysts, such as the platinum surfaces that are in the catalytic converters of our automobile exhaust systems. The way that catalysts work is understood very well.

What catalysts do is to lower the energy barrier of the transition state that separates the reactant waveform from the product waveform. For example, you could have a bottle filled with an explosive mixture of hydrogen and oxy-

gen, and if there is no spark to set it off (the spark provides the activation energy to get the reaction started), no reaction will occur even if you wait for a very long time. However, if you were to drop in a pinch of platinum catalyst, the mixture would explode instantly. This is because the catalyst lowers the energy barrier enough so that the ambient energy of the mixture of the gases is enough to spill over the lowered barrier, and BAM.

It accordingly appears that this is how the 0-force does what it does. It is acting like a catalyst to lower the energy barrier between a waveform at its current position and the quiescent waveform at an adjacent position. Thus, when the neuron "intensifies the Reality" of the quiescent waveform of the contracted muscle cell, what it is really doing is to push down the energy barrier that separates the waveforms, so that the energy spills over into the adjacent quiescent waveform.

Notice that there is a very different situation here than normally occurs when something moves. Ordinarily, motion results only after the waveform of an object such as the box has been distorted to its transition state by your pushing against it. Since, at the moment the mass and energy of the box waveform spills over, the waveform of the box is in the distorted state, it spills in the distorted state. Because it is in the distorted state when it spills, the quiescent resonant waveform that is chosen to accept the energy is also in the distorted state, and is therefore poised to spill again, and so on.

However, when the 0-force causes movement to occur, it does it in the catalytic sense by pushing down the energy barrier, although the barrier is not reduced to zero. This means that less distortion of the box waveform is required to push it over the transition state, and therefore less energy is required to overcome inertia and cause the box to move.

Since it crosses the energy barrier in a less-distorted state, the quiescent waveform that best resonates with this less-distorted waveform, and thus accepts its mass and energy, is also less distorted. Motion will therefore occur with a smaller investment of activation energy to get over the lowered energy barrier. Moreover, since there was less investment of activation energy, the object will possess less momentum. One can see that when motion is catalyzed, the object in question will have less inertia to overcome, and therefore can be set in motion with a smaller investment of energy, and will therefore possess less momentum and can be stopped with less energy.

This may appear to be getting something for nothing, but it is not; and no chemical or thermodynamic laws are violated. For example, suppose there was a chemical reaction that, in your experience, always needed to be heated up in order to go. You would reasonably assume that for the reaction to occur without having to heat it, would be impossible. But if you were given an appropriate catalyst for the reaction, you could now get the reaction to go at, say, room temperature. If you knew nothing about chemical reactions, transition states, and how catalysts work, you might believe that it was magic. But it isn't magic. It is very understandable and we make use of it all the time. Especially in our bodies where thousands of enzyme catalysts are what make the chemical reactions of life possible.

Having thought through all this, we suddenly see how it is possible for the alien space ships to go from a standstill to high speed in an instant and can make perfect right-angle turns at high speed. This seems to us like an impossible violation of the laws of inertia and momentum, but that is because, up to now, we had not known that motion is a chemical reaction, so we did not realize that motion can be

catalyzed. The aliens have clearly learned how to catalyze the chemical reaction of motion in a completely controlled way. Since the motion is catalyzed, and results from lowering of energy barriers instead of distorting waveforms to reach the energy barrier, there is much less energy required to overcome inertia in order for the alien ship to get under way, and therefore much less energy is required to overcome momentum in order for it to turn or stop.

Overcoming inertia and momentum are ordinarily very wasteful of energy, because the energy involved is usually thrown away. You have to put a lot of energy into an automobile to overcome its inertia to get it rolling. To stop it, you have to dissipate this energy. We do this with brakes, which convert the energy of momentum to heat, so it is lost. It would be really nice if you could get under way with less investment of this activation energy, and then stop with less energy. A catalyst of the chemical reaction of motion would make this possible.

Artificial neurons and the catalysis of motion.

If the aliens have succeeded in developing such a catalyst, what might it be and how might it work? The simple answer is that they have figured out to construct a really big artificial neuron, or a collection of artificial neurons, that possess a powerful energy source. Up to now, the only way to catalyze motion has been by Nature's neurons, whose energy is limited to the metabolic energy that they can produce within themselves. An artificial neuron with a large external power source would not have this energy limitation, and so could exert its effects at much greater distances than a biological neuron can. Whereas the only object whose motion can be catalyzed by a neuron is the

muscle cell in which it is embedded, the artificial neuron could move objects that it is not in contact with. Such an artificial neuron, powered by an abundant energy source, could do marvelous and varied things.

One thing it could do is aid us in moving around. We could have vehicles that could be set in motion without having to overcome inertia and could be stopped without having to overcome momentum. The "neuron" would have to supply enough power to overcome friction, but the energy required to start and stop would be minimal, with the exact amount being determined *by* how much the transition state energy barrier is lowered by the catalyst. Controlling the speed of transit would be done using the principles by which catalyzed reactions can be regulated, as is achieved with enzymes that are regulated by the biological conditions of the cell. Guiding and controlling the craft would logically be achieved by psychic means; that is, the neurons of a human navigator would need to be interfaced with the artificial neuron.

One can imagine that the bridge of the alien spacecraft has a chair for the helmsman to sit, and a wide-angle high-resolution view-screen so (s)he can observe the surroundings of the craft in exquisite detail. The chair provides the interface between the neurons of the helmsman and the artificial neuron of the ship, and the ship simply goes where the helmsman wants it to, in exactly the same way that your arm raises up when you want it to. As long as the helmsman is in the chair, the ship becomes a part of his/her body, and is accordingly under the control of the helmsman just as is any body part. The ship will then be able to perform the kinds of maneuvers that are observed with alien ships, such as going from a dead stop to high speed without a period of energy-requiring acceleration, rapidly stop, and make perfect right-angle turns at high

speed. Such a ship could achieve near-light-speed with little expenditure of energy, and then require little braking energy to stop. This would eliminate a major barrier to our exploration of space.

The reports that alien ships appear to be able to do these things shows that the principle of constructing an artificially-powered giant neuron is possible. If they can do it, we can do it; we just have to get on it. To do so will require a marvelous collaboration of scientists of every kind, since to build the artificial neuron will require application of knowledge from all the scientific disciplines, especially biochemistry, cell physiology, physics, chemistry, engineering, and mathematics. Unlike the Manhattan Project to build the atomic bomb, which required only physicists, to build an artificial neuron that can catalyze motion will require input from absolutely everybody. It could be our finest hour.

Another thing that comes up again and again with aliens is that they have some kind of beam or ray that can lift things up and carry them around, even move them through walls. One can see how the big artificial neuron could do this, too. What the neuron does is to intensify Reality. If the artificially powered neuron were to fix an object in its gaze and pour energy into its waveform, the object would become more intensely Real than the unpowered waveforms around it. Gravity itself is the consequence of the intensification of Reality, so the intensification of Reality of the object by the neuron would have the effect of overcoming gravity, and it could float in the air. It could be made to move while floating using the same catalytic mechanism as is used in moving a ship. As the object with intensified Reality approached a wall, it could pass through it because its hyper-intensified Reality is much greater than that of the wall, which would be comparatively ephemeral.

Perhaps the neuron could somehow suppress the Reality of the wall as the object is going through it.

If the artificial neuron can do these things, it can do other things as well. It would be a "tractor beam," which frequently makes an appearance in science-fiction shows. In its tractor-beam mode, it could fix an object in its gaze and simply intensify the Reality of the object at a fixed position. Its struggles to move to another location would be to no avail, since the waveforms of the object at another location could not be made Real enough to overcome the Reality of the object at the fixed location.

The neuron might also become the "death ray," of science-fiction fame. If you were to fix the Empire State Building in its gaze, the neuron could intensify the Reality of the grains of sand in the concrete, and reduce the Reality of the concrete matrix holding the grains together. The building would collapse in a heap of rubble.

Finally, one can imagine that the artificial neuron could allow telepathy, perhaps over long distances. Just as the helmsman can guide the ship by merely thinking where he wants it to go, the artificial neuron could be set to resonate with an individual's thoughts. These resonances would be amplified by the artificial neuron, which would radiate outward and interact with other appropriately-attuned neurons, which would "feel" the thoughts of the first neuron.

Clearly, this artificial neuron could be used for great good and great evil, just as we have seen with atomic power. However, it seems pretty certain that an artificial neuron could not possibly be built without the builders first becoming completely knowledgeable about the Time Dimension and the fact that our lives in the Present Moment are not an end in themselves, but part of an endless series of cycles in which our Souls move back and forth

between the Present Moment and the Time Dimension. An understanding of this process as well as understanding our crucial role as Observers in determining the Destiny of the universe will have the effect of enhancing our better nature and suppressing evil.

The final question about aliens is, why don't they make contact with us? It is probably because we are not ready. Imagine going into a primitive Hottentot village and walking around, looking in the windows of grass huts, and noticing that there are donkey carts and such. Even if you knew nothing at all about Hottentots, it would take maybe five minutes to decide that they knew nothing about internal combustion engines, or how radio and television waves can be broadcast through the air. You would also assume that their religious beliefs were greatly different from your own, and if you were to try to establish a meaningful dialog with them and teach them the scientific principles that would make automobiles and television possible, and to teach them our religious principles, that it would be very disruptive to their way of life. Missionaries used to go into primitive villages to do just that, but attitudes have evolved and many now believe it is better to leave them alone.

When the aliens look around our planet, they see no forms of transportation that employ artificial neurons to overcome inertia and momentum. They look in our windows and see how poorly many children are treated. They see that most of the people in the world live in abject squalor, while a fortunate few have grabbed everything for themselves, and once someone has managed to achieve the good life, there is no thought other than just hanging on to it until death. They would see that we have defiled the planet, and destroyed its species of animals with abandon.

Aliens and the cycle of Souls.

As they see these things, it is clear to them that we do not understand the cycle of Souls between the Present Moment and the Time Dimension. If we did understand it, we would not defile the planet and decimate its creatures, because that will destroy the evolutionary ladder that Souls need in order to evolve into human Souls. Once this ladder is severed, the supply of new human Souls will be cut off, and we will cease to be able to enlarge our role in shaping the Future of the universe.

The fact that so many live in abject squalor shows that the Souls who have gotten the good life do not know that they will soon be tossed back to share the squalor. The shabby treatment of children shows that we do not realize that we are destined to become children again, and again, and again. So the aliens go away and leave us alone.

But suppose we do come to understand about the cycle of Souls, and our role as Observers? When this happens, there will be a revolution of human society. We will realize that we all share a common destiny, and for one group of people to become rich while others are miserable makes no sense, and we will seek to change things so all can live a decent life in which each Soul can grow and improve. We will love our children as we will want to be loved when we are children again. We will come to treat our planet as the Source of Souls, and hold the Earth itself and all living things in great reverence, and seek to protect every type of living thing. We will understand that there will come a day when we will need to leave the Earth to fulfill our Destiny among the Stars. When that day comes, we will need countless new human Souls, and the only way to get them is to extend a helping hand to those Souls who are ascending the evolutionary ladder, struggling to become human

Souls. We cannot allow the ladder to be broken, because if we do, our numbers will be forever frozen.

We will realize that Observers who do not fulfill their Destiny will be relegated to the role of onlookers, while other Observers do the job of fulfilling the Destiny of the universe. One can imagine that some Observers, those who never came to understand the cycle of Souls and their role in the universe, inevitably became consigned forever to the Time Dimension, just as the Dodo bird is probably consigned, because by becoming extinct along with its relatives up and down the evolutionary ladder, it has lost access to the ladder and is forever doomed to be a Dodo bird Soul.

We can expect that as we acquire an understanding of the cycle of Souls and our role in the universe, that our planet will change. Groups of people all over the earth will choose to live in a state that is conducive to personal and spiritual growth. This does not necessarily mean rich with material possessions, but rich with things that nourish and enhance the Soul. Everyone will participate and share in all the arts; experiencing, creating, and participating in drama, dance, music, theater, painting, poetry, literature, architecture, and sculpture. This sharing of art is extremely important, because art is communication between Souls, and provides a conduit for the exchange of spiritual energy among Souls. Music especially will be revered, because music is waves as we are waves, and to experience music is to experience the essence of which all things are made. To become one with music, to use our bodies as instruments of its creation, and to move our bodies in harmonious response to music will be exalted.

Children will be loved and mentored so that their Souls can experience growth during that phase of life in which they are most impressionable. Every adult will con-

sider it a sacred duty to help children grow in a spiritual way. Hostilities and prejudice between groups will cease, because we will understand that each of us will eventually experience lives as either sex, and as different religious, ethnic, and racial groups, and any yoke that one group fashions for another group, we must eventually wear ourselves. We will recognize that the fundamental desire of all Souls is toward improvement and eventual perfection, and that each Soul should be accorded dignity and respect.

Each of us is on a long road that cannot be traversed without the help of others. Those moments of our existence that find us in good circumstances provide opportunities to help others, just as others have helped us. As our understanding of these things becomes complete, we will not waste a life of wealth and privilege on indulgence in material comforts, but will instead use our resources to help other Souls to overcome adversity and to improve.

When the aliens visit us after we have done these things, they will see that our planet is not defiled, that there is reverence for all forms of life, that all people are treated with shared respect, and children are loved and nurtured. They will hear beautiful music, and see art and abundant beauty throughout the land. They will see our mighty ships start from a dead stop and suddenly dart at full speed toward the horizon. And on the way, take right-angle turns at full speed.

They will look at each other and nod. They will know that we have finally learned about the cycle of Souls and the inherent responsibility that all Observers have for the Destiny of the universe. They will know that there is likely a legend of the Father or Mother among us, and perhaps how the Son or Daughter was once sent to save the world when it was in a spiritual crisis. They will know, that if they were to contact us, that they and we would find shared val-

ues and common purpose, and that our religion and their religion would fit together like perfect puzzle pieces.

When that day comes, the mighty alien ships will descend and their doors will open and they will walk among us. And from the very first moment, we will be friends.

Exploration of the Time Dimension.

As these thoughts come to a conclusion, I see that my mastiff is still looking into my eyes. He seems to want me to think about one more aspect of the Future. He looks into my eyes very deeply, and I feel I am falling asleep. As I fall, I begin to think about something that happened several months ago, while I was sitting in my office eating my lunch from a brown bag. Suddenly, a former science colleague of mine appeared at my door holding some old books in his hands. He pressed them into mine and said, "I think you should read these."

The books were about Edgar Cayce, a clairvoyant. My colleague and I had had a brief conversation a week earlier, during which I had suggested that if you couldn't observe something, it didn't exist. I had preferred not to elaborate beyond that, since I considered that my little hobby of thinking out the ramifications of "that which cannot be observed does not exist" to be like growing mushrooms on horse dung in the basement, or keeping slugs as pets. There is nothing really wrong with such hobbies, but one is reluctant to tell people about them for fear that they will think them mildly disreputable activities. My philosophical musings were for my own amusement, so I seldom mentioned them to anyone. I therefore thought it odd that this conversation had triggered his dragging these strange dusty vol-

umes out of his library and bringing them to me. I thanked him and said I would look at them, but I doubted I would really do so. Maybe a glance or two, just so I could say I had.

I have never had much patience with the paranormal; not because it is completely unbelievable, but because everything to do with it is so filled with charlatans and hoaxes, that sorting out what could be true from what is false is hopeless. So the books sat in my office for a couple of weeks. Then I became concerned that my colleague would drop in and see that I hadn't touched them, so I took them home. There they sat unopened for more weeks.

Then one Sunday afternoon, when I was struggling with the implications of waveforms and observations, I walked past the pile of Edgar Cayce books on the table. It suddenly seemed beyond coincidence that they were there, and that there might be something in them that was relevant to what I was thinking about. I picked up the one that was on top, and began to flip through it. I got a big surprise.

Cayce was a simple man and relatively uneducated. He made a living as a photographer, and in his spare time, practiced as a clairvoyant, mainly to help people solve problems and get over illnesses. It has been reported that when practicing this capability, Cayce would go into a trance, and if he were using his powers to treat someone who was ill, all he required was their name and address. He could then locate that person from within his trance and analyze the source of their illness. He would prescribe treatments, often quite bizarre and apparently irrelevant, that tended to work if followed exactly.

While in the trance state, Cayce would respond to questions about the source of his power and information. Under such questioning, he responded that there was a collective, or universal unconscious, and it contains the indi-

vidual unconscious. He further stated that every action of mankind since its beginning has been incorporated into a universal "record," that is available to anyone who has developed the ability to read it. And that, "Conditions, thoughts, activities of men in every clime are things; as thoughts are things. They make their impression upon the skein of time and space. Thus, as they make for their activity, they become as records that may be read by those in accord or attuned to such a condition. They may be illustrated in the wavelength of the radio or of such an activity. These go upon the waves of light, upon that of space. And those instruments that are attuned to same may hear, may experience, that which is being transmitted." At another time, he stated, "Activity of any nature, as of a voice, as of a light, produces in the natural forces a motion, which passes on, or is upon the record of time. This may be illustrated in the atomic vibrations as set in motion for those in that called the audition, the radio in the activity ... Hence, the forces that are attuned to those various incidents, periods, times, places, may be accorded to the record, the contact, as of the needle upon the record."

This description is strikingly consistent with the idea of waveforms that extend back through time, and suggests that the information within these waveforms can be accessed by entities that are appropriately attuned to them, in the way that the resonators of our brain can access the information in its Past waveform. Inasmuch as he was an uneducated man, his use of the terms radio waves and atomic vibrations and waves of light by accident seems unlikely.

The things Cayce could accomplish in the trance state is consistent with his being able to detach his Soul from the Present Moment and wander among the waveforms of the Time Dimension. Perhaps he was able to control what we

now call the Out of Body Experience. Many people claim to have had these, but I have not. Nor have I had any other kinds of psychic experiences. We now see how the Out of Body Experience is possible, in that the antenna part of the Soul might detach itself from its close association with the body and drift among the waveforms of the Time Dimension. People with Out of Body Experiences report being able to "fly" from place to place with great ease. This explains how Cayce managed to treat his patients by knowing nothing but their name and address. His Soul could detach itself from his body and drift over to 4th and Elm street, and then go to find the waveform of his patient that was lying in the bed upstairs. To analyze it, he might not even have to touch the body at the Present Moment, but simply delve into the Past waveform of the body that was present in the Time Dimension.

When Cayce was asked if his powers were unique to him, he replied that they were within everyone's capability. This suggests that there are great reservoirs of psychic powers within each of us, only awaiting our understanding of how to tap them. If Cayce could cure the illnesses of others with his powers, we can do the same; presumably even keeping tabs on our own bodies and curing its illnesses as they arise.

One of the things that surprised Cayce very much was his discovery that our Souls had lived through many lives, and had originated somewhere at the beginning of Time. He stated that the source of his clairvoyance was derived from having lain mortally wounded on a battlefield in a former life, and he escaped from the torturous pain by letting his Soul drift away from his body. He retained this ability when he entered his next life.

It seems he made something like 40,000 "readings" during his life, and they are all written down somewhere in

Virginia Beach, where he lived and worked. He didn't write any books himself, so the Cayce books are essentially collections put together by people who have rummaged through some of this. You can imagine what kinds of people would do this, and the kinds of books they would write. Cayce books accordingly end up on the occult bookshelves, where they probably belong. But he did these things so consistently over such a long period of time, and so many of his patients recovered from their illnesses by following his strange prescriptions, that there is much sentiment that if there is any such thing as a true clairvoyant, Cayce is it. He never became rich from his capabilities, because for some reason he was not able to use his powers for personal gain, only to help others.

Suppose Cayce was a true clairvoyant, and during his trances he did travel through the Time Dimension. A thoughtful perusal of his transcribed readings by persons with open minds might provide much insight about what it is like there. We would probably also learn much about the psychic potential of the human mind. Once we understand what is possible and why it is possible, there will be an incentive to learn how to develop this potential so that everyone can do at least what Cayce did, and some people much more.

This suggests that it will become commonplace for people to allow their Souls to temporarily depart from their bodies and wander in the Time Dimension. They will find there a permanent record of everything that has ever happened in the history of the universe. We have always assumed that once something has happened, it is over and can never be revisited. But in the Time Dimension, all is preserved. The waveform of every person throughout all of Time is there, as a faithful record of every instant of their lives. Because the memory waveform of a person has

recorded every sensual experience and every thought, it should be possible to visit those waveforms and experience what they contain. One could look out Cleopatra's eyes as they watch the launching of a thousand ships. One could break the bread and share the wine during Jesus' Last Supper, and feel his pain as he was nailed to the cross. One could feel the outpouring of love from a new mother to her baby, and walk in the moccasins of the beggar on the street. To truly know, for the first time, the joys, sorrows, and pain of other Souls.

The inevitable result of this activity, when conducted during the eternity of Time that is before us, will be to knit Souls together as if they are one. Each Soul will be like a droplet of rain, and as human Souls share their experiences and thoughts and dreams, and fears, and everything, the individual droplets will tend to merge into puddles, which will merge into streams, which will combine to eventually form a great River in which each Soul has made its contribution to the whole, but its identity as an individual Soul becomes diffuse, and all Souls will come together as a river of shared experience.

The Door at the End of the Universe.

As we approach the end of the universe, what will a human being have become? Perhaps a Being who is stunningly beautiful because it is a merged composite of every human Soul, with a face that is a composite of all faces. All the men and women, and all the children, with traces of ourselves and everyone we have ever known, everyone we have ever loved. Written across this face are all human experiences. All joy, all sadness, all pleasure, all pain. All the wisdom of the ages. Knowledge of the birth of every star

and every child. The death of every planet and every person. The laugh of every baby, the tears of every woman, the fears of every man. Every sunrise and every sunset. Every hope, every dream. Every success, every failure. Simply everything. Like a God.

So what will this God do as it approaches the Door at the End of the Universe? Perhaps, in order to fulfill its purpose of existence, it will simply go through the Door. But perhaps, through the eternal ages, it will have divined another purpose. Perhaps, as it approaches the Door, it can move ever slower. Perhaps it can even stop, and never go through.

This God will have traveled a long road. The beginning of the road may have been rocky and difficult, but because the God, during the days before it was a God, made choices that were choices of noble purpose; the road toward its end has become beautiful, and the God wishes to tarry on that road a while. Being a God, it can tarry as long as it likes.

Epilogue

Resonance and the Music of the Spheres

Everything is the way it is because of resonance. The universe began as if Thor smote a cymbal with his mighty hammer, and the universe now consists of the resonances of its reverberations. As the universe progresses, instant by instant, the next instant is always the one that resonates best with the present instant. Although one can imagine a Future instant that would be better, the only Future that can happen is the one that resonates best with the Present. This is why even the best of all possible worlds can harbor imperfection.

The universe is a symphony, and all its spheres are music. One of the most interesting and important themes of this symphony is played as an obbligato, that began as the barest whisper and is growing, and will eventually dominate. just as the theme of Ravel's *Bolero* first intrudes quietly, and then grows slowly but relentlessly, constantly increasing its strength and power, each moment unfolding into the next with an inevitable seamless perfection; on the one hand constantly inventive, but also predictable and true to itself, it grows and becomes more inclusive of all the instruments who join, one by one, until all are playing the theme in a great crescendo.

This obbligato is Life. Without it, the symphony of the universe would be dull and predictable, with no invention. But because of the obbligato, the universe is filled with possibilities, just as a piece played by a jazz musician is filled

with possibilities. To the jazz musician, every riff is the one that makes the most sense at the current moment, each one moving into the next in a rich combination of predictability and invention. As each riff is played, it creates a sense of inevitability as it progresses, note by note. Each note resonates with the next. But at each note, there is also an element of non-predictability; there are other choices that make nearly equal sense, and a different jazz musician, with a different set of musical experiences, might choose one of those instead. And once chosen, it would also seem inevitable.

So it is with the universe. Without Life playing its obligato of invention, the universe would play itself out to a completely predictable final chord. But with the inventions of the obligato, the universe can riff toward a multitude of possible final chords. Whereas the final chord of any symphony seems an inevitable conclusion to what has come before, every symphony has a different final chord; and it takes a great composer to create a final chord that perfectly sums the whole.

So as we live our lives, we are participating in the composition of the greatest symphony that is possible. Our every action is a riff that takes the universe in a new direction, toward a different final chord. We therefore need to weigh carefully the consequences of what we do. We need to seek the harmony in our every action, to help compose a symphony that has a final chord of sublime beauty and perfection. Perhaps the final chord must be of perfect beauty, and be perfect in its harmony within itself and with what has gone before, for our Souls to reach salvation.

Appendix

The following section presents the concept of motion as a chemical reaction in the style of a scientific manuscript.

The Translocation of Objects as a Chemical Reaction and a New Law of Motion.

Summary

It is proposed that physical objects undergo translocation through space by a chemical reaction mechanism. This hypothesis allows the process of translocation to be analyzed and understood using the principles that govern chemical reactions. By assuming this mechanism, one can explain the basis of inertia and momentum; as well as why matter must exist as waves, the dual wave/particle nature of light, the ability of photons to propagate as waves without an apparent conductive medium, the limit to the velocity of light, and the Uncertainty Principle. The hypothesis also erases the distinction between a physical change and a chemical change, causing physics to merge into chemistry. The possibility that the chemical reaction of translocation can be catalyzed is considered, and its implications are discussed. The concept of translocation as a chemical reaction is used to derive a new law of motion that combines Newton's Laws of Motion into a single mathematical relationship that redefines the nature of a force, and includes terms for inertia and momentum.

Inertia and momentum are attributes that are universally associated with objects that are at rest or in motion,

but a demonstration that inertia and momentum arise from first principles has not been possible (1,2,9); which argues that we do not understand the mechanism by which material objects undergo translocation. Whereas it seems intuitively obvious that an object passes through an infinite number of intermediate locations when it undergoes translocation, the philosopher Zeno argued 25 centuries ago that the time required to do so would be infinite (6), thus creating a paradox. This paper presents a solution to Zeno's paradox, by proposing a mechanism of translocation in which an object moves through a limited number of non-infinitesimal steps, rather than an infinite number of infinitesimal steps. The proposed mechanism not only resolves the paradox, but also accounts for inertia and momentum, provides answers about why matter exists as waves, the dual nature of light, the ability of photons to propagate as waves without an apparent conductive medium, the limit to the velocity of light, and provides the basis of the Uncertainty Principle.

These insights are attained by assuming that objects undergo translocation by a chemical reaction mechanism, and that translocation is best understood by applying our knowledge of the principles that govern chemical reactions; as opposed to, say, our knowledge of particle physics. To develop this idea, it is useful to think of an object A, consisting of atomic orbitals that have merged into some combination of molecular orbitals, at rest. Inasmuch as the quantum vacuum teems with virtual particles and energy (3,5,8,10), one can imagine that the volume of space that contains object A also contains a multitude of virtual objects that possess no energy or mass, and therefore have no material existence. This means that object A is surrounded by, and superimposed by, virtual representations of every conceivable material object; including versions of

object A that are identical to it in every way, atom for atom, except they are at different locations. Accordingly, there is a cluster of perfect virtual objects A that lie an arbitrary distance to the left of object A, another cluster to the right of object A, another above object A, and so on at every distance in every direction.

Now consider that object A is an entity that can undergo chemical reactions through breaking and forming chemical bonds, and these bond changes are accompanied by changes in the shapes and energy levels of its atomic and molecular orbitals. The top panel of Figure 1 shows an energy diagram of the progress of a simple ordinary chemical reaction of reactant A to product B, in which reactant molecules collide, and the energy of the collision provides the activation energy (ΔG^\ddagger) required to distort and reorganize the molecular orbitals of the colliding molecules to become like the high-energy state (\ddagger). Once the transition state is attained and crossed, the molecular orbitals continue to reorganize themselves until the product structure is attained. If the energy content of A is different from that of B, the reaction is exergonic if A is greater, and endergonic if B is greater. Figure 1 shows a profile in which A and B possess equal energy content; there is therefore no net change in energy and the only energy change during the process is the investment of ΔG^\ddagger , which is recovered completely.

When reactant molecules collide, they do not always possess the energy and angle of approach that is required to achieve the transition state, and instead ricochet and simply undergo translocation away from the point of collision. However, let us now suppose that Zeno is correct in his argument that it is impossible for a material object to translocate by moving through an infinite number of intermediate locations. In the face of this supposition, we must

consider some alternative mechanism of translocation that involves non-infinitesimal steps. Let us focus on object A, which has acquired energy by means of colliding with another molecule. This energy has resulted in a distortion of its molecular orbital structure, which now partially resembles the transition state that separates it from product B. However, unless the transition state is attained completely, the molecular orbital structure cannot reorganize itself to become a molecule of product B. Object A is now in an unstable state, in that it possesses insufficient energy to attain the transition state that separates it from product B; but it cannot simply fall back and become a stable object A again unless it has a place to put its acquired energy. Having used Zeno to rule out "simple" translocation as a mechanism to dispose of this energy, a startling alternative will be considered; which draws upon the idea that object A is surrounded by a multitude of virtual objects A, each identical to object A, atom for atom, except they are at different locations. Chemically, the virtual objects exist as sets of empty orbitals, and any of them could become a real object A if its empty orbitals could be filled with appropriate mass and energy. Now suppose that the excited real object A transfers its mass and energy into the orbitals of an adjacent virtual object A, in a manner that is very similar to an ordinary chemical reaction, as is illustrated in the bottom panel of Figure 1. In this "translocation reaction," the activation energy that has been imparted to object A at position *a* distorts its orbitals so that it becomes like the transition state that separates it from the virtual object A at position *b*. Since the virtual object A has the same orbital structure as the real object A, the energy required to achieve this transition state is lower than the transition state toward product B. As the transition state is attained and crossed, the mass and energy of the real object A are trans-

ferred into the orbitals of the virtual object A at position b , and once the transfer is complete, the virtual object becomes a real object A at position b ; and object A has now "moved" from position a to position b . Since the energy levels of all orbitals are quantized, the distance between a and b must also be quantized; and the magnitude of the distance would be a very small, but not infinitesimal, "quantum-sized," distance. The fact that object A at position b is identical to object A at position a , atom for atom, is explained by the fact that all chemical reactions proceed along the path of least resistance, so the energy pathway that will be chosen for the translocation will be one in which the translocation product has exactly the same bond structure and conformation as the reactant of the translocation step, and it is this virtual object A, which possesses precisely these qualities, that is selected to receive the mass/energy of the translocation step; thus preventing a struck billiard ball from turning into a chicken as it proceeds across the table.

We are now confronted by an interesting situation in that the activation energy that caused object A to transfer its mass and energy to an adjacent virtual object has not in any way been dissipated, so object A at position b is still in an excited state, and will tend to do the same thing again; which is to transfer its mass and energy into a virtual object A at position c . Unless there were some mechanism to drain this activation energy away, the object would continue to move indefinitely through positions d , e , f and so on. We can immediately see that this provides an explanation of inertia and momentum. As illustrated in the bottom panel of Figure 1, *inertia* is the activation energy that must be invested in order to distort the orbitals of object A to become like the transition state that separates it from a virtual object A at an adjacent location, and once the transi-

tion state is attained and crossed, the activation energy is recovered to be used over and over in subsequent translocation steps. Once invested, the activation energy becomes the *momentum* that the object possesses, and the only way to remove this activation energy is to drain it away by friction or placing objects in its path. It is reasonable that objects should possess inertia and momentum in proportion to their mass, because a larger mass would require a larger input of energy in order to distort its orbitals to the transition state, and once the transition state has been crossed, would recover this larger amount of energy to provide the activation energy for subsequent translocation steps, and hence possess "greater momentum."

It follows that a massless entity such as a photon could achieve its transition state without an input of activation energy. If this is the case, one would expect that photons would be in a constant state of translocation, which is what is observed. Moreover, the dual wave/particle nature of photons is readily explained by assuming that the wave-state of the photon corresponds to the photon in the transition state, while the particle-state corresponds to the photon in its reactant/product state. Since translocation is a chemical reaction, the transition state and reactant/product states would be in chemical equilibrium with each other, and if translocating photons were to strike a physical object such as a photon detector, the detector should be able to detect the photons in both states, which is what is observed. One can also explain why photons translocate at a rate-limited velocity. This is because all chemical reactions are rate-limited, which is generally a diffusion-controlled limit; and at the diffusion-controlled limit, it is the rate at which the transition state can be crossed that is the rate-determining step. Since massless photons do not have to undergo an energy-requiring distortion to reach the

transition state, their velocity is limited by the rate at which the transition state can be crossed, which is the same for all waveforms.

This hypothesis also allows us to understand how it is possible for waves to propagate through empty space, and why matter exists as waves. The empty orbitals of the virtual objects A serve as the conductive medium, and are the functional equivalent of the hypothetical ether (4); but we have never noticed them, or detected them in experiments, because they have no material existence. It is the fact of translocation in which the mass and energy content of object A progresses through a series of virtual objects A, each one existing temporarily as a container of the mass and energy of object A, and thereby having a momentary existence as a real object A; that establishes that these virtual objects are not merely a philosophical conjecture, but have crucial relevance to the real world. "Solid," or non-wave matter would not be able to undergo the changes in orbital structures required to achieve the transition state, and thus be unable to translocate. Such "solid" matter could never become distributed throughout the universe, and could therefore not be used to create the kind of universe that we know; which is why the matter of our universe exists as waves.

Finally, the hypothesis provides a basis for the Uncertainty Principle. All chemical reactions constantly participate in a dynamic exchange between reactants and products, so the real mass of object A is constantly oscillating among a spherical collection of virtual objects A whose center is located at position a , which is the statistically most-probable location of the real object A. However, the equilibration process makes the likelihood of the mass actually being at position a instead of position b at any arbitrary instant statistically uncertain. Since the activation

energy barrier that separates reactants and products is higher for large masses than for small masses, large objects would equilibrate among surrounding virtual objects to a lesser extent than would small objects, thus making the location of the real mass of a tiny object, such as an electron, relatively uncertain compared to a large object, such as a billiard ball. This is consistent with what is observed.

One can expect that our understanding of this new mechanism of translocation will have useful applications. An example is that a chemical mechanism of translocation points toward a way to translocate objects without having to "overcome inertia and momentum." If translocation is indeed a chemical reaction, then one can expect to manipulate this reaction using the same chemical principles by which we manipulate "ordinary" chemical reactions. One of the most important means for manipulating chemical reactions is by the use of catalysts; which perform their role by reducing the energy barrier to the formation of the transition state (7). Catalyzed reactions can proceed with a much smaller input of activation energy than an uncatalyzed reaction. Figure 1 illustrates that catalysis of the chemical reaction of translocation would mean that less energy would be needed to overcome the inertia of objects in order to get them to move; which would therefore possess less momentum and be easier to stop. Such catalysis would be of obvious benefit to many human activities, especially in transportation. Whereas the means to achieve catalysis of translocation is not obvious, the fact that it is theoretically possible should be conducive to the discovery of the means. It has been suggested elsewhere in this work that the catalysis of translocation has already been achieved by biological systems, in which case an appropriate study of these systems should lead to an understanding of the principles of the catalysis of translocation.

The major argument in favor of translocation being a chemical reaction is that it effortlessly resolves all of the intractable conundrums of physics as described above, none of which is satisfactorily explained by any other hypothesis. In so doing, no new discoveries or principles of physics or chemistry were required, but merely a novel implementation of established concepts. What is new is that the hypothesis erases the fundamental distinction between a physical change and a chemical change, and that physics can now be seen as chemistry. This is demonstrated by using the hypothesis to derive a new Law of Motion (see *footnote*).

Footnote

The concept of translocation as a chemical reaction allows the reformulation of Newton's Laws of Motion into a single new equation that includes terms for inertia and momentum. Accordingly, the expression for velocity is:

$$v = \frac{I_0 M_f}{m} \Delta E_v,$$

where ΔE_v is a discrete amount of energy that has been imparted to the waveform of an object by another waveform, with the transfer of energy being achieved in the way that one vibrating tuning fork transfers energy when pressed against another tuning fork; which is by a series of pulses, with each pulse transferring a discrete packet of energy (ΔE_v) from one tuning fork to the other. It is a vectoral energy (ΔE_v), because it is imparted from a particular direction; and therefore distorts the waveform toward the transition state that separates the real waveform from the virtual waveform at the next location in that direction. The

waveform resists this distortion because of the elasticity of its chemical bonds, and the amount of deformation that occurs in response to the energy input is determined by the *Inertial Modulus*, I_0 , which is a constant of elasticity with units of g-cm per unit of vectoral energy. Once distorted toward the transition state, the waveform passes over the transition state (*i.e.*, moves) at a rate determined by the *Momentary Frequency*, M_f . It is the momentary frequency that explicitly reflects motion as a chemical reaction, and represents the rate of transition over the energy barrier of the transition state, and has units of sec^{-1} . This equation shows that the magnitude of the velocity of an object waveform is proportional to the inertial modulus, or the ease with which it is distorted to the transition state. It is the resistance to deformation that constitutes the amount of inertia that the waveform possesses. Experience shows us that the velocity of an object depends only on the amount of energy put into it and its mass, so the magnitude of I_0 must be constant for all kinds of matter, with the amount of deformation being inversely proportional to its mass, which is accounted for by putting mass into the denominator of the equation. The consistent relationship between energy, mass, and velocity argues that the magnitude of M_f is also constant, and is independent of the composition of the waveform. This in turn argues that all waveforms are constantly oscillating between a ground state and a transition state, and are therefore always in motion; with the direction and velocity of the motion determined by the extent to which the waveform is vectorially distorted in the direction of a particular transition state. Once so distorted, the waveform will undergo translocation in that direction indefinitely, until an opposing vectoral energy distorts the waveform in the direction of a different transition state. It is the momentary frequency term that accounts for the phe-

nomenon of momentum, and determines the rate at which an object waveform moves in step-wise fashion from one virtual waveform position to the next. This rate is always constant, so the actual velocity is determined by the distance moved at each step, which is in turn determined by the vectoral energy imparted to the waveform, and the extent to which this energy distorts the waveform, which is determined by its mass and I_0 .

Consideration of this equation in light of experience reveals interesting features. One experience is that as objects approach the speed of light, their apparent mass increases. The equation predicts this, in that I_0 is like other constants of elasticity, so the extent of deformation in response to energy input decreases as the elastic limit is approached, which is when the speed of light is approached, whereupon further increases in velocity are not possible because the waveform cannot be further distorted without destruction. A surprising feature of the equation is that it shows that objects that are undergoing very rapid translocation are in a state of high elastic tension, and just as a highly-stretched elastic band is attempting to return to a more relaxed state, a rapidly-moving object is attempting to slow down, and would do so if it could just discard some of its energy. This is normally achieved by colliding with other objects, but the pressure to discard energy would cause it to utilize any means available, including radiation; and the faster an object is moving, the greater this tendency would be. Whereas this tendency might not be noticeable with objects in our everyday experience, it could be significant with rapidly-moving celestial objects, which would show an otherwise-anomalous tendency to slow down. This could have important implications for the future of the expanding universe.

The equation for velocity can be differentiated to give an expression that relates inertia, momentum, mass, and the vectoral input of energy, to acceleration (dv/dt):

$$\frac{dv}{dt} = \frac{I_0 M_f}{m} \frac{d\Delta E_v}{dt}$$

which upon rearrangement becomes:

$$I_0 M_f \frac{d\Delta E_v}{dt} = m \frac{dv}{dt}$$

which is mathematically indistinguishable from the simpler $f = ma$, but provides more insight into the nature of what a force is, and shows that the efficiency with which a particular energy input is converted to acceleration is determined not only by mass, but by inertia and momentum. Whereas the classic concept of a force is that it is continuous, this new equation explicitly shows that a force is made up of discrete packets of vectoral energy, with each packet being expended to cause a discrete increase in velocity. In order for the velocity to increase continuously, new packets of energy must be continuously supplied, and the rate of increase in velocity is proportional to the rate at which this is done. The efficiency with which the input of energy packets is converted into an increase in velocity is inversely proportional to the mass of the object, and directly proportional to the inertial modulus and the momental frequency. Since I_0 and M_f are universal constants, and thus never change from one circumstance to another, they have been inadvertently and inappropriately combined with the $d\Delta E/dt$ term to give $(d\Delta E/dt)I_0 M_f$, which is interpreted by Newton's Second Law as f , or *force*, which we now see is vague and meaningless, because it is a

confusing combination of the true force, which is $d\Delta E/dt$, together with terms for inertia and momentum. Now that the terms for true force, inertia, and momentum have been separated and appropriately defined, it will be possible to derive other equations that relate force and motion, to replace those in current use; which are stilted, cumbersome, and unfathomable. This will be done elsewhere.

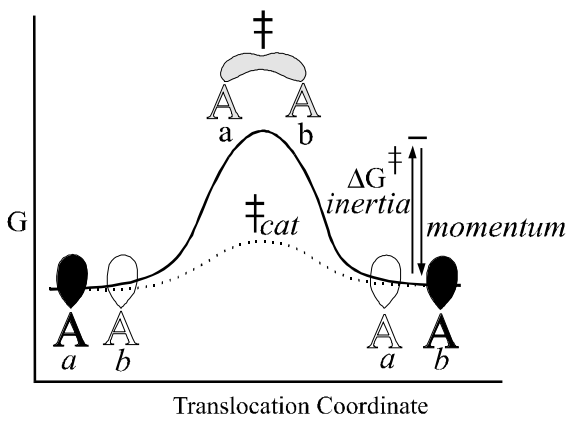
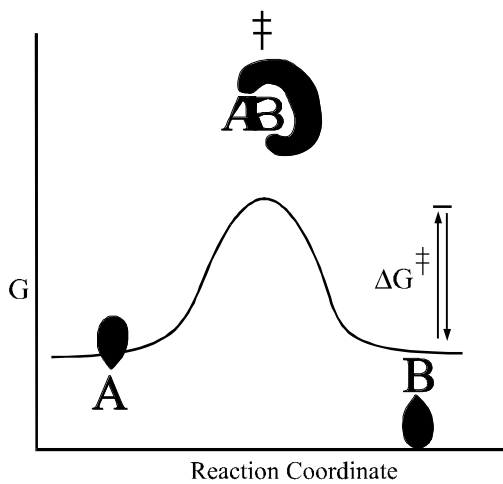


Figure 1

Figure Legend

(*Top panel*). Transition state diagram for an "ordinary" chemical reaction in which reactant A is converted to product B through a high-energy transition state (\ddagger). The energy of activation is ΔG^\ddagger . The *filled* balloon above reactant A represents a molecular orbital that undergoes rearrangement in its shape and energy level as it goes through the transition state to acquire its new shape and energy level in the product B.

(*Bottom panel*). Transition state diagram for a "translocation" chemical reaction in which the reactants are a real object A at position *a*, and a virtual object A at position *b*. These objects exchange their mass/energy as they go through a high-energy transition state (\ddagger). The products of the reaction are a virtual object A at position *a* and a real object A at position *b*. The ΔG^\ddagger of formation of the transition state is identified as *inertia*, and the ΔG^\ddagger that is recovered as the transition state is converted to product is identified as *momentum*. The *filled* balloon above the real reactant A represents the total nuclear and molecular orbitals filled with the mass and energy of reactant A; and the *unfilled* balloon above the virtual reactant A represents the corresponding empty orbitals. The *partially filled* distorted balloons of the transition state represent the stage at which the mass and energy are exchanged between the filled orbitals of the real reactant A at position *a* and the vacant orbitals of the virtual reactant A at position *b*. The dotted line illustrates that a catalyst of the translocation reaction would reduce the amount of energy required to

reach the catalyzed transition state (\ddagger_{cat}), therefore reducing the magnitude of the inertia and momentum that object A would manifest during translocation.

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