Everwhen

David Stafford

This page is for all the funky numbers and such:

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Technical Consultant: Goober Arrou

211 East High Street
Mooresville, Indiana 46158

This is dedicated to Susan; my keel, my home, my love.

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Looking Sideways

If you have some time, I would like to invite you for a small adventure. Like an airplane ride, it shouldn't take long, but it may take you to new and far vistas.

How often are we enlightened by looking at the other side of an issue? The old saw that "there are two sides to everything" can give insight to problems that make solutions easier to find. Simple clichés don't do the subject justice, but the number of these clichés, from the Golden Rule on down, point to the widespread knowledge that seeing both sides helps. (We need a new word for cliché, it has gotten so, well, cliché.) Often the answer to a dispute lies with an impartial third party, one who looks at the problem from the side, and not from the perspective of either extreme. To be sure, there are times when one extreme or the other is totally unreasonable, mistaken, wrong; but I digress. The lesson is that there are many ways to look at everything, plenty of ways, usually thousands of ways or more.

Fortunately for me, my dyslexia was not detected when I was young. Written words and numbers made little sense to me, but I eventually learned to cope. Reading backwards now comes as easy as forwards, but rarely is of much use. The reason I feel lucky is that I learned to check my answers to be sure I had it 'forwards', by reading the problem backwards and seeing if my answer worked. To be sure, I'm not always right; often, very often, I'm wrong, but I am always ready to change my viewpoint. My friends and family will be surprised to hear that admission of wrongness, but not to hear that I look at things from somewhere else. I do love problems, the harder the better, for I find that if I change my point of view, not only can I understand the problem better, but I can almost always find the answer.

Searching for the truth is a futile but glorious adventure. If you care to join me, you should be ready, like me, to leave at home everything you believe to be true and right. If you find new truths, great. If you find some of your old ones are false, that's also great. And if you find new ways to see that your old truths are indeed true, fabulous. But if you take any of your old

treasured beliefs with you, they will slow you down, cause you to veer off the path, and prevent you from finding a better understanding. Any belief that is indeed true will be waiting for you when you get back home, steady, steadfast, and as real as any truth you can have.

The first definition of an essay is a trial or test. These essays are some of my excursions. Please now place any beliefs that you may have in the overhead storage bin.

An American Sage

Benjamin Franklin, while perhaps best known as a sage and a kite flier, was also one of America's supreme wits. While goofing off in Paris as an ambassador, he wrote a letter to a local paper explaining how the Parisians could save a huge amount of money. It seems that they didn't know that the sun was actually shining hours before their usual wakeup time of noon. He noted that they burned huge quantities of tallow by staying up most of the night. Old Ben suggested that the fine folk of Paris arise earlier in the day, thus going to bed earlier and saving a fortune on candles. He suggested ways of enforcing early risings; for example, he suggested putting a tax on any window shutters that kept the sun from waking folks in the morning, and if that didn't work, he proposed firing a cannon on each street at an early hour.

While the Parisians may still sleep until noon, his letter did result in his getting credit for Daylight Savings Time. Imagine that! He told a joke and got credit for making the sun come up! I'm sure that his American rearing, his frugal and industrious nature, and his just plain good sense combined to make Franklin wonder at the wasting of both daylight and tallow. Perhaps "Early to bed, early to rise . . ." was out of place in France, but it sure caught on here in America.

Skip forward a couple hundred years, and thanks to Old Ben we have saved plenty of candles for decoration and emergencies. We have other reasons for saving daylight now. Half of the year we take one hour of sunlight to the National Daylight Savings Bank. Is this so we can make withdrawals in the winter, when we dearly need the extra light? No. Instead we use that hour in summer evenings, so that we may play outside, tend our crops, and in most places, tear up the roads with construction. It is good to be frugal; the extra daylight we get by forcing the sun to stay up longer is indeed handy to have. So why then do we quit saving it in the winter?

Would Ben Franklin approve of our squandering daylight all winter? I think not. Most of us already go to work or school in the dark all winter, and often come home in the dark. Imagine his arguments today: an extra hour of sunlight on

winter evenings would cut down on traffic accidents for weary homebound workers, students would have more time to make snowmen or do homework by natural light, and fewer people would stay up late watching lousy TV.

The argument that we need the extra hour in the summer is even stronger in the winter. If daylight savings time makes sense, and it has its points, then it only makes sense if it is used year round. “Everybody else does it” does not make anyone healthier, wealthier, or wiser, but there's always somebody who forgets to reset his clock, and he is usually less of all three.

Oh, and about using a cannon to wake up the Parisians? That didn't work. They spent the extra time trying to surrender.

Danger! Math Ahead

Perhaps one of your most solid beliefs is that 1 + 1 = 2. I told you to leave those beliefs at home. One plus one is usually two, but only usually, not always. It depends on what is being added. Sometimes it is zero, and sometimes it is much more than two. Sometimes one person working on a task, plus another's help, can result in the task being accomplished, when one person alone cannot accomplish even half. And sometimes adding another person means nothing will get done.

One ocean wave plus one ocean wave can become a surfer's delight or a flat sea as the waves enhance each other or cancel each other out. One photon of light plus one photon of light can result in anywhere from zero to two photons worth of energy. That's wave theory, easy to verify in the kitchen sink. One atom of hydrogen plus another can become one molecule of hydrogen (H_2), or one atom of helium plus some energy, or just two separate atoms of hydrogen, each going its own separate way, all depending on the temperature. That's chemistry and nuclear physics for you, but don't do that experiment in the kitchen sink. It's easy to generalize and think that the result of this equation is really two, but accurate measurement can expose that there is almost always a small loss of heat or mass. Of course the loss goes somewhere . . . usually.

Examine the two photons that collided and resulted in no photons. One little dab of energy plus one little dab of energy equals no energy. The two were out of phase, opposing each other, and canceled each other out. Now examine a similar case of an electron and positron colliding, one matter, the other anti-matter. The result is not electrons and positrons, but a lot of energetic photons, annihilation as matter and anti-matter collide. Now let's look at this from another angle, from sideways in time. An electron travels through time and hits a photon that is traveling backwards in time. The electron reverses itself in time, becoming a positron, traveling backwards in time. The "anti"-photon also bounces and becomes a photon going forward in time. Too weird? Perhaps, but this is a valid definition, as demonstrated in scientific experiments. It has been done repeatedly and it fits all the results, weird as it seems.

The worst is yet to come. If the 'one' is a speed of 100,000 miles per second, and you add another 100,000 miles per second, you are not going 200,000 miles per second. Instead, you are going about 118,000 m.p.s. That's relativity for you, it almost sounds like payroll taxes. Time dilation: the faster you go, the slower time appears, and adding more speed gives less and less of an increase. However that strange fact is very handy to physicists studying really fast particles in nuclear accelerators. Einstein's theory of relativity seems to work. Remember that photons travel at the speed of light, 186,000 m.p.s., the cosmic speed limit, and guess what? To them, time and distance, the place where we live, doesn't exist. To a photon we are zero in size and never existed.

But take heart. One stupid idea plus one stupid idea is still two stupid ideas.

And Sergeants Too

Here we are in the most powerful country in history, yet our government has failed us. Every day thousands of people are hurt, injured and even killed by the laws of nature. We must demand that our politicians repeal or amend those laws! No longer should we have to endure pain when we stick our hands into a fire, get careless and fall off a step, or bang our shins into furniture in the dark. What good is a powerful government if it cannot protect us from nature's use of corporal punishment?

Many people are working hard to stop punishment in our judicial system, in our schools, and even in our daily lives. It's time to stop being punished by natural laws too. Just because we do something wrong, we shouldn't have to suffer!

Now, there will be those who tell us that pain is a warning to help us avoid dangerous or harmful situations. They may argue that changing nature's laws is not within our powers. They will even argue that pain is one of the greatest teachers, but those people just don't have enough compassion. It's time to outlaw nature's retribution! It's time to rid the world of pain and suffering!

That seems rather stupid, doesn't it? The fire will eventually cook your hand to a crisp if you don't have enough sense to pull back. The ground will rush up to your face and leave a mark if you aren't watching your step. And if you bang your shins hard enough and often enough, you can eventually bang the furniture back with the wheel chair you'll be confined to. No, it seems that the pain nature metes out is a useful way to learn that pursuit of some bad actions will lead to worse situations.

People can learn naturally from pain that there are rules best not broken, but nature can sometimes be very slow in teaching that lesson; at times too slow. The problems of too much wine will not be taught until the next day, going outside in the cold without a warm coat may take a week to fully teach a lesson, and poor eating habits can take years to wreak havoc. In fact, many of the warnings that good old Mother Nature gives us are subtle, slow, and hard to learn from.

Now consider the poor behavior of a child hitting a fellow kindergartner. The child who was hit may quickly learn to avoid the hitter, but the offending child may learn nothing. A quiet word not to do that again will work for some the first time, but others will need a stronger word the next time. And some will grow to adulthood never heeding the words. For some, no pain, no lesson. I was raised under the flag of "spare the rod, spoil the child," and I'm a quick learner, but for others it may take a little more rod. Nature teaches best with quick and mild pain, and worst with slow and vengeful pain. Corporal punishment is best if quick and mild, but late, excessive, or none at all, can sometimes result in a long and terrible lesson. Nature will continue corporal punishment. So must we, on occasion, but only as a learning tool.

It would be nice, however, if we could repeal the law about eating beans.

Chatting with Friends

It has come to my attention that some people believe animals cannot talk. To be sure, it's impossible to carry on a lively conversation with some. Mosquitoes don't seem to understand your displeasure, skunks seem to have only one response when you address them, and have you ever tried to order a fast food burger without pickles?

The problem is one of vocabulary. It's easy to irritate a song bird by imitating its song, even though you may have no idea what it is singing about. In that conversation, who is it that doesn't understand? It's as likely you are proposing marriage as discussing the weather. Dogs can't talk, true, but they have several sounds and gestures they can make, each with a different meaning. They can convey information, like "I'm happy," "Hey, this is my yard!" and of course, "I need to go outside." And dogs can learn what some words mean: their name, "come here," and their perennial favorite, "No-no!" It's not the sounds and gestures that are meant to be conveyed, it's the information. Communication works because people, and some animals, can learn that sounds and gestures have meanings, but until both sides learn to associate a sound with a particular meaning, no information is accurately passed. Misunderstandings are common, and often unrecognized, because each side has learned a different meaning for the words.

Pictures can convey information -- even some of those international road signs. A mere facial expression can carry a lot of meaning, and some guys still just don't get it. Apparently the printed word works with you and me, but pets don't seem to get much out of the printed word, even though they are willing to contribute. Common understanding is the key. You can learn the meaning of what another says, but the underlying principle is that you both understand the situation being described from the other's viewpoint.

Mosquitoes have simple needs: to eat, to breed, and to avoid your swatting hand. They have no reason to talk. Social insects -- ants, bees, termites -- communicate their information with scent, but only to those of their kind, those who understand the smells. Dogs have many more needs, and have sounds and

gestures to convey those needs. We can learn to understand those, if we wish.

To shift your viewpoint does not mean to embrace the other's viewpoint, only to see it. To understand why someone wants something can help you decide to lend a hand or tell them where the nearest nature trail is. And sometimes it's not possible to understand; sometimes shifting your viewpoint many times fails to make sense, because sometimes the only message being presented is “I'm crazy.”

Words do not solve problems, understanding solves problems. Words in print and sound can improve understanding, but so can gestures and grunts. The secret to understanding is in learning the other's needs and wants, which incidentally works very well with people.

Cats are a special case. They are fluent in English, but they have no desire to know of the needs or wants of others. Their only concerns are “ME” and “NOW.”

The Universe, on Balance

OK, this one is a little harder. The power of positive thinking may be very real, but it cannot be measured. Electricity seems to be real, and it's easy to measure. So is gravity. There are two other forces known to science that are quite real -- the strong and the weak -- but they aren't as easy to measure. Centrifugal force, well known to many of you, doesn't exist at all. I told you this would be harder.

The universe, as we can measure it, has at least four forces. Those forces are in a very delicate balance. How delicate? Try stacking several razor blades on edge, one atop another. Shoot, try stacking two. If we give the strong force (that holds atoms together) a value of 1, then the electromagnetic force (light, heat, chemistry) has a value of 1/137 (.0073), and the weak force (don't ask) is 10^{-6} (0.000001). Oh, and gravity, that force that you feel right now, that keeps you glued to your chair, is 10^{-43} . That's small. That's a decimal point with 42 zeros and a one behind it. Gravity is weak. That's why gravity doesn't pull atoms apart. Usually. Even the gravity inside the sun cannot pull an atom apart. For purists, that is the atomic nucleus, but I hate footnotes.

The balance between these four forces is rock solid, unchanged through almost all the history of the universe. Despite a ratio that would balance a butterfly against billions of stars on a teeter-totter, we are safe. All those zeros are beyond comprehension, but what if we took just one of those zeros away? The average football offensive lineman would weigh one and a half tons, the average hamburger would weigh 2 ½ pounds (pre-cooked), and this book would be heavy reading indeed. Well, that's not exactly what would happen. What would happen is that the universe, as we know it, could not exist. If gravity was stronger, it would inhibit or prevent many chemical reactions, so no life. If the strong force was stronger, no nuclear reactions, no sun. If electric forces increased, no atoms, no nothing. The same would happen if we added a zero, but who would hire a 30 pound football lineman?

Our very existence depends on that balance of forces. There are some who claim that other universes with different

balances exist, and we're not there because we couldn't exist there. Maybe they're right, but who cares? We are here, standing on top of a huge stack of balanced edge-on-edge razor blades. Despite that delicate balance, we are in no danger of collapse, for the stability of the stack is unshakable.

Centrifugal force is really just the resistance of the weight at the end of the string to changing direction. Just simple momentum, like our resistance to new ideas.

Perhaps you are now inspired to spend years getting a college degree in advanced physics . . . or not. But the more you learn about the universe, the more obvious it is that the universe was designed. Designed by one who understands balance.

10,000,000,000,000,000,000,000,000,000,000,000,000,000,000 to 1 !

The Barking of Dogs

It seems to be popular now to take offense, to be chagrined at a turn of phrase, to be insulted by words that sound like other words that are deemed offensive. To be insulted when called “anti-” whatever instead of “pro-” whatever else. To feel denigrated by another person's harsh words. To feel threatened when another shows a knitted brow and wears a frown.

Have we reached the level of sensitivity where a simple laugh is considered to be an attempt to demean another, to steal their self-esteem, to destroy their self-worth?

I have the answer to all of your worries. I am pleased to offer *Dave's Special Ego Booster*, available in handy 12-ounce recyclable cans, or in convenient capsule form. *DSEB* is non-fattening, containing zero calories, zero grams of fat, no cholesterol, no carbs, and no peanut butter. It's non-habit forming, not made in third world sweat shops, and contains no endangered plants or animals, and no dangerous minerals. It is, in fact, thin air.

Anybody that gives you self-esteem is giving you thin air. No one can bestow on you self-worth, self-dignity or self-honor. Those are only available from within yourself. Only your own decisions to do what you know is right, to work hard to achieve a goal, to choose to resist an ill temptation, will put value within your own life. And no one can diminish that value but you. Honor is never given, only earned; and never stolen, only given away. No words or deeds of another can undo the honor you have earned unto yourself. Others can take your money, steal your car, even beat you senseless, but never undo your past accomplishments.

As you walk down the street, a strange dog may bark at you. He may not like you, may not like the color of your scent, may not like the sound of your walk. The dog may want to chew your leg off, but he is only a dog. He cannot chew your self-esteem, bite your honor, or diminish those things you have accomplished. He's just a dog. Do not give him the power to make you believe less of yourself. Remember that a dog doesn't know of your hard work, he's just a dog. Remember that the one who wants to insult you has his own flaws, and probably

doesn't know it anymore than he knows your good deeds. And remember that no one else sees from your eyes, and that other perspectives can never be yours; but that does not mean they are looking down on you. If they frown, they may not understand your viewpoint, or perhaps they have gas.

You alone can work at building your honor, by making your world a better place for everyone in it, by setting a goal and trying to reach it, by not taking the easy way out. And you alone can lose your honor by tearing your world down.

And if you have yet to be kind to a stranger, yet to climb great mountains, and have slipped on occasion into bad habits, if you have no self-esteem, no honor, no self-value, then send $29.95 (plus $4.95 shipping and handling) to *Dave's Special Ego Booster*. Be sure to specify cans or capsules, and allow 6 to 8 years for delivery. Sorry, no C.O.D. orders.

I'm Pro-Peace

The number of people with ideas on how to fight a war upsets me. They expound rules of conduct, how to plan, and even who should and should not be in the line of fire. I am upset that they are so certain of their convictions, so sure of their compassion, and so confident in their knowledge. When hearing their expertise, I see that they have no idea. They know nothing about war.

My father served in combat in the Pacific, and I in Vietnam, yet my mother, my wife, my brother and sister, and my children have absolutely no understanding of what we, and thousands of other veterans, have endured. We served not because of some old document, some current laws, nor any religious tenants, but because it was the right thing to do. We served not to conquer some remote land, but to stop those who did want to conquer. We do not talk of combat because there are no words that we share in common with our families and friends. No words convey the feelings that gripped us in combat. No words that can let you and them know what war is like, how it feels, how it tastes, because it is not like anything here. So how can I be surprised that they are ignorant of war?

Now again we have been attacked, and again some of us have gone to stop the aggression. Those who take up arms go alone within themselves, to do what must be done, to do what is right, to stop the danger, and to learn and endure what those who stay behind will never understand. They have gone to restore the peace that others took. They have not gone for their own peace.

We served that you would be free, that you would be safe, and that you would not know war. Perhaps I am not so upset at what you do not know.

My Favorite Joke

Einstein once said that space and time were continuous, not made of small parts; or at least if they were, the parts were so small as to not matter. It has taken me decades to see the humor in that, so don't feel lonesome. The humor lies in the spaces between those very small parts, and it is very funny. Sorry, but I thought you should know.

More Science Yuck

Quantum dynamics can describe the colors of a sunset with a great degree of accuracy, even allowing for quantum uncertainty. Astrophysics allows us to precisely predict the time of sunrise years in advance, if it's not cloudy that day. Biological science can fairly predict the neuro-chemical joy of eating chocolate, and the extra pounds that come with it. Meteorological science can be very precise about yesterday's weather, most of the time. By studying our world, in great detail, using scientific methods, we can learn how many things work. How, but never the underlying why.

The formulas of quantum dynamics describe what will happen when light hits the atmosphere and bounces into your eye. Newton's formula for gravity, with a very small correction from Einstein, can tell us where the earth will be when you drop that family heirloom, and exactly how fast it will be going when it shatters on the floor. And everyone knows that a pound of chocolate can be metabolized into three pounds of fat. It's doubtful anyone knows why it rains more often on the weekend, but we know it does. All of these formulas and theories can predict what will happen, and can describe, usually in boring detail, the outcome. Almost. There is always a margin of error, an uncertainty, a chance to completely blow it. Why? Because they are just descriptions of what will likely happen, never explanations of why. We know gravity is related to mass, but we do not understand gravity, what causes it or why it works. It is the same with all the other laws.

There is even a new science, called chaos theory, which tries to describe the fact that we cannot accurately describe anything.

How can we predict the peace of mind that a beautiful sunset can give, the thrill of a new roller coaster, the satisfaction of eating a really good piece of candy, or the comfort of a warm fire on a cold and stormy night? We can't. Nor can we predict the ugly colors that some people choose to wear, why that fancy vase fell off the table, why a box of chocolates always has a piece with a yucky center, or where a tornado will strike.

Now for one of Dave's wild leaps of viewpoint. There

are no atheists.

There are people who enjoy watching sunsets who cannot believe that God would allow anyone to wear that ugly shirt. People who enjoy good food and don't believe a divine being could cause a famine. People who think that gravity just is. People who just don't like the way God made the universe, and conclude that therefore He must not exist. People who believe that science will someday know enough that we can rebuild the universe to suit: no diseases, no bad weather, no danger, and no hate.

I, on the other hand, am comfortable with the quantum uncertainty principal, can follow the math of Einstein's general relativity and know of biochemistry's vagaries. Not well, but enough to know that the universe is a marvelous place, with levels of balance we cannot begin to understand. A design that is too well done to be random. I can enjoy seeing a colorful sunrise or watching a spider spin its web, and I can understand ugly, that it has its place, contrasting and enabling beauty. All without worry that I will never know the why, and with no illusion that the universe was made just for me. It's a marvel to find myself in such a wonder-filled place that allows me to be.

Goober Teaches

When I was a younger man, I wanted to be a teacher, but that young man would have been a very poor teacher. To teach, you must know your subject, and that was not the case. Richard Feynman, who perhaps understood more of the universe than any other person, said that if you cannot explain something in simple terms, then you too don't understand it well. A few years ago, older, and somewhat wiser, I decided to teach my dog how a color TV works. Hey, he was a really smart dog, and I knew my subject. His name was Tramp, but we called him Goober, and he would pay close attention when spoken to.

The lesson began by my pointing out that the picture on the TV was made up of dots arranged in horizontal rows, one after another, stacked down the screen. The dots are electrons projected from an emitter behind the screen, directed to the right place on the screen by variable magnets, and impact the phosphor on the back side of the screen, making the phosphor glow. Goober patiently listened while I explained how this stream of electron dots was converted and amplified from the radio waves that came from the broadcaster. He liked the fact that the stream was so fast that the dots cover the entire screen thirty times a second. He likes fast. I explained that the broadcaster uses a camera that scans the scene the same way, creating horizontal rows of dots, stacked vertically, as the light from the scene hits the electronic sensor inside the camera lens. The light becomes a stream of electrons that is amplified and then used to change the shape of the radio waves that are then broadcast to our TV antenna. I explained that to send color, the camera actually uses three pickups, each filtered for a color, either red, blue, or green, and all three streams are sent via the radio waves. The three streams are re-combined when they hit the phosphor on the screen, producing a color picture, all made up of rows of dots. Just like Morse code, it's a stream of dots arranged in rows, but with the rows stacked to make a picture. Black and white TV was just one stream of dots, but color required working out all the little problems of splitting and recombining three streams.

The lesson was going well as I expounded on the merits

of taking a big problem and breaking it down into smaller pieces. Goober really likes chewing things to small pieces. The smaller pieces are easy to examine, to turn over and around until you find the answer to the small problem. He likes turning around a lot, too. Once all the small problems are solved, they can be put together to solve the big problem. A wonderful lesson for life, to take everything one small piece at a time, solve that piece, and move on to the next. But you must always remember the big picture, to keep your goals in sight and not go off chasing the scent of a rabbit.

To measure my teaching talent, I asked Goober if he had learned how a color TV works. He said that he was color blind, and could he have another biscuit?

Aren't We All

Einstein defined insanity as doing the same thing over and over and expecting different results. Apparently he understood governments, too. I'm kind of partial to Einstein; he perfected his theories of relativity while sitting alone in a row boat on a Swiss lake. I cannot begin to understand that level of genius. He did, however, break my cardinal rule. He could not accept quantum theory, even though its foundation, Max Planck's discovery, was also the foundation of his own work. Einstein could not accept that God had put uncertainty at the core of the universe. See? He took one of his cherished beliefs with him on his search for the truth. His belief in how God had made the universe more than slowed him down. He spent years trying to reconcile his God and the evidence of quantum mechanics.

Planck's big discovery was small. It is actually the definition of small, specifically, 6.626×10^{-34} Joules per second (that's energy over time). That is the size of a quantum of energy, for energy is only available in groups of those quanta. A photon may contain one, or two, or millions of them, but never a half, nor any other fraction, of one quantum. Matter comes in small chunks, mostly electrons, protons and neutrons, which are made of smaller chunks called quarks, and energy also comes in small chunks. And that was a huge discovery.

As a reward for continuing to read this essay, I shall now reveal what I believe to be the soul of the universe. If matter and energy come in small discrete chunks, what about time and space? Einstein's accidental joke was that time and space are either continuous -- that is, without breaks -- or else the parts are so small as to not matter. It is either one or the other, and if time is made of small parts, then those parts must be smaller than the Planck constant. Any bigger, and that constant wouldn't be constant.

So what? The gap between quanta of time is what. How big is the gap, what's in the gap, can we go there? The gap can be as large as you want it to be. It's outside our time and space -- how many grains of sand can you store outdoors? You can put another universe in the gap, you can put an infinite number

of universes in the gap. You can put an infinite number of universes in each of the infinite number of gaps. How many universes do you have? Can we go to one of those other universes? I don't know. Is there any limit to what can be inside those gaps? I don't see how there can be. It seems the best place to put heaven and hell, Star Trek's warp drive, good government and everything else that has no contact with our universe. Decades of contemplation have given me no way to limit that multitude. I have, however, run into a slight problem. It looks as though the ubiquity of those gaps will lead to leaks, a loss of stuff from our universe. Not a loss of energy or matter, they shouldn't fit through the cracks. Instead, a loss of stuff like geometry, time, space, socks in the dryer -- you know, stuff like that. The math of this involves probabilities, which also appear to leak out.

I have to put my money on the continuity of space and time.

Because I believe this is important, you may say, “Dave, you're insane.” Perhaps I agree. After all, my favorite definition of insanity is the inability to distinguish fantasy from reality, and I'm still trying to find reality.

A Wake for Orange

Music is a wonder. It is so easy to enjoy, if you can find the right station, yet so delicate when done well. That so many can do it well, across so many styles, makes me green. Not to be left out, I took my usual approach and decided to make a musical instrument, learn how to play it, and make my own music. I love woodworking, and my Pop's workshop called to me. I planed maple and walnut to thin sheets and built a six string 'guitar' of unusual shape, a shape dictated from studies of acoustics. I learned the mysterious $1/17^{th}$ spacing rules and accurately placed frets made of apple, the hardest wood at hand. I researched the best finish, and selected the only varnish we had. I saved my allowance and bought a set of tuner pegs and strings. I learned I needed to reinforce the neck to withstand the tension on the strings, and made its replacement stronger.

Now I was ready. I bought a how-to book on playing, some sheets of my favorite music, and went back for a pitch pipe after reading the first page. I noted that I couldn't read music, but I knew I could learn when ready. The guitar training book had simple fretting examples, so I could get started without sheet music. If only I could figure out why the pitch pipe didn't work. No one in my family was musical, we had no instruments or training, so I found a local guitar instructor. "Teach me how to tune this." He was taken by the beauty and craftsmanship, and took out his own pitch pipe. That's when things started to go bad. He proceeded in minutes to tune my toy, and demonstrated how to match the pipe to the string. Slight problem. I could *not* hear *any* similarity between the pipe and strings. To me they were always totally different. Oops.

He and a friend who was accomplished in all string instruments ran my creation through various songs and we all agreed it looked much better than it played. My guitar had a resemblance to a flat bottomed balalaika and the musical qualities of a cigar box. The blending of light and dark woods made a beautiful decoration above the TV. Me, I still love music, but only from beyond the footlights.

Some people are blessed with perfect pitch, whatever that is, and I have been blessed with the same discretion for

color. I can match a color I saw yesterday, pass judgment on complementary colors even from memory, and tell you the proportions of colors needed to mix a matching paint. This essay is in eulogy for orange, a humble, oft maligned, but warmest of colors.

Orange is the first child from the marriage of Red and Yellow, two of the primary colors. Television, using red, green and blue, can only approximate orange. The tone is off key. The profusion of bubble jet printers all use magenta, cyan, and yellow, and they too play that note badly. To my eye, the modern creations play the spectrum as poorly as my guitar played music. I understand the chemical and electronic choices necessary to make a cheap color display, even down to the level of quantum dynamics, but I miss one of my old, warm friends.

Color mixing is delicate to my eye. Orange goes well with red, yellow, and brown but never with purple, blue or green. Mauve and taupe aren't colors, they are abominations, as is chartreuse, yet I have seen them all mixed in an evening sky to breathtaking beauty. Only God can mix orange and blue. I would like to strike a deal with those of you with tin eyes; if you won't mix opposite colors, I won't sing. Thank God for tiger lilies.

Time Travel Made Easy

Sitting in a train car, watching the world go by, is funny. The world isn't moving past your window; you are moving through the world. You remember the places you have passed, see where you are, and sometimes can envision where you will be. But all of those places were there before you saw them, and they are still there after you have passed. That's what is funny. It's funny because everyone says "Time goes by," and never "We are passing through time." Time is a dimension, similar in most ways to the three dimensions of space. The dimensions don't move; we do. Yesterday is still real, all that was there is still there. The future is real, it is where it will be. Although we don't know what is there, or how it is arranged and shaped, the future will become the past after we have passed by there. But unlike the train, we can steer the future to some extent.

A simple marble, round from all directions in space, is different when seen from sideways in time. From sideways in time, it is a round rod, stretching from the past to the future. Each moment of the marble's existence is solidly connected to the one before and the one after, with no gaps. And the marble-rod is stiff, it resists bending, for bending is changing the direction it's moving. That's acceleration within the three dimensions of space. The stiffness is called momentum. If the marble is spinning, the marble-rod is spinning, lengthwise, and that's called angular momentum. It takes force to bend the marble-rod, and it takes force to start or stop it spinning. Now things get fun. No force known can break the marble-rod. Split it into many smaller rods, to be sure, but that looks like the unraveling of a rope, not breaking.

Now things get fuzzy. Two marbles revolving around each other become a braided pair of marble-rods. Make the marbles small enough, and they look like an atomic nucleus. Add some electrons, and you have a braid surrounded with a fuzzy covering. Wrap two atom-rods tightly, and the fuzzy coverings intermingle, and you have a molecule, held together by the fuzz called electricity.

Now things get weird. Seen sideways, these tiny rods stretch from the extreme past to the far, far future. We don't

"see" it that way because we use light to see. Light too moves from the past to the future, moving out from the braid at an angle until it hits our eyes. We "see" only the immediate, when the light hits our eyes, and what we see is the past, the braid when the light left it. We cannot see yesterday's light, because it has passed us by, nor tomorrow's, because it has not yet left the braid. But just because we cannot see yesterday's braid, does not mean that it has ceased to exist, that the marble-rod has been broken or destroyed. Yesterday is still there, and tomorrow is real too.

For those few of you still with me, I promised to make time travel easy. Easy? *Not* traveling through time is hard, maybe impossible. Now for the bad news. When you learn to travel backwards in time, you cannot take anything with you. Nothing. No books, no newspapers, no Swiss army knives, and nothing that you have learned can be carried with you. You won't even know that you traveled back in time. Sorry, you cannot go back to before you were born, nor forward beyond your death, because you unravel. Now for some fun. Your entire life is solid from beginning to end, and will last, will forever be a part of the fabric of the universe.

God exists outside of time. He can see it all, from beginning to end. Perhaps we too can gain His perspective. I hope you like the view.

Welcome to the Club

Why are vegetarians so closed-minded, biased, and bigoted? I have probably just insulted scientists and mystics, Parisians, religious zealots and atheists, smart and dumb alike. But it's time to point out the sheer hypocrisy of the vegans. They come in various levels and degrees, from those who won't eat anything warm and fuzzy, with big sad eyes, to those who won't eat anything that moves, but always their prejudice stands out like a glaring beacon. Respect for life is noble, commendable, but the vegans have cast most of the living onto the charcoal grill of damnation.

I speak, of course, of plant life. Just because a living, yes even breathing, life form cannot move out of the way of the sickle does not mean that it is fair game. While plants don't have eyes, they can certainly sense the sunlight. Sunflowers follow the sun across the sky. While plants don't have central nervous systems (and neither do many animals), they can definitely sense temperature, touch, and yes, even pain. The mimosa tree will close its leaves at a gentle touch. Grass will emit chemical cries of pain at being cut. Even without nerves, plants can send signals to their farthest limbs, and to others nearby. Plants have feelings too!

Does the only proper diet consist of water, rocks, and sand? But I agree that we should respect *all* life, past, present and future, and respect that all living things have value. My stupid idea is that nothing should die young or unloved.

Ignorance is best defined as the lack of knowledge or understanding. I am ignorant of a great deal: how to speak Chinese, what you had for breakfast, where I left my good pen; but more importantly, ignorant of almost all of the universe. I do, however, know that I am ignorant.

Stupidity, on the other hand, is the inability to know or understand. It's not possible to know some things, like why God made the universe, what an electron looks like, how celery feels when you bite into it. So, in some ways, we're all stupid. As a young man I thought I was really stupid. There was so much I could not understand: how to interact with my peers, why the sky is blue, why some people like sauerkraut. As the years went

by, I learned what worked and didn't work when talking to others, often at great cost. I learned about optical refraction and color absorption, even the quantum physics that makes the sky blue. I still don't know why people like sauerkraut. But the smarter I got, the more I realized that I didn't know. Whenever I think I'm smart, I pick up my book on quantum electronics. One look and I know I'm stupid. I often feel like a founding member of Club Stupidity. But at least I know I'm stupid.

In that light, I try to learn, try to understand, and try to see things from a different perspective, so that I might better appreciate the wonders of nature and my fellow humans; so that I might respect life, past and future, and non-life, and indeed, all the glorious universe that God has put us in. From studying the nature of time to enjoying waves on the beach; from trying to listen to great thinkers to watching clouds roll by my window; I try. I can see that God always gives us what we need, even though we may be too stupid to understand, and though it is not what we want, think we want, or wish for.

Will Rogers said that everyone is ignorant, just on different subjects. I say that we're all stupid too, just on most subjects.

To any of you that these essays may have insulted (except the French), I am sorry, please read my apology titled *The Barking of Dogs*. And welcome to the Club.

Only One Week

On one of my early time travel trips to the past, I took a TV, a VCR, a generator, and a tape of Carl Sagan explaining the origin of the universe. My destination was back before electricity, and I knew that if the people back then could watch Dr. Sagan, he could explain, much better than I, how it all began. I barely escaped with my life. Rather than seeing what was on the boob tube, those people ran screaming from the sound and light. They ran straight to the town square where they prepared a large stake and bonfire for me. My destination of Salem, Massachusetts, was probably not the best choice.

Later I made another trip, this time to 1922. The people there marveled at the color and visual effects, the sights and sounds, and I didn't even have to take a generator. After they saw the show, they deliberated on the concepts presented and decided that I should be burned at the stake. Scratch Dayton, Tennessee, from my itinerary.

The pilgrims understood the sailing ship that brought them to America, but not that their ship was made of countless atoms and molecules, held together by forces they were centuries from discovering. Both sides in the Scopes Monkey trial believed in God, they just couldn't agree on how He made people. One side wanted to learn how, one side wanted to believe in something they could understand. Just as my unfortunate time travels revealed, our history is made up of explanations that fit the knowledge of the day. And our knowledge today is nowhere near what it will be in many tomorrows. Whether God took 13.6 billion years to create the universe, or seven days, is not important. It was His decision. We can never fully know how or why, so why argue about that? Instead we can learn more and more about His work, finding more wonders and mysteries to admire. And if he only needed one week, perhaps we may learn how He got His suppliers to deliver on time. Was it the penalty clause?

All I wanted to do was to get people to stop believing in Mother Nature. I wanted them to know that all of her laws were really God's laws. That God made the physics that set the sun to shine, the flowers to bloom, the birds to sing, and the gravity

that made the rain to fall. Also that He made a world where famine, floods and pestilence happen. A world where love could happen, and a world where hate could happen when love was threatened. The world is as it is, not how some mystical Mother Nature let it be, not how we might have made it ourselves, but how God made it. He made a world where we could evolve, could grow and learn, love, and enjoy His creation and His rules, even if we can't understand why.

It is a world where death happens, for without death, there would be no room for the next generation. A generation who will learn more of God's creation, who can share more of the joy and sadness laid before us. A generation who will overcome more than we know, and still enjoy the simple beauty that surrounds them. A world where they too can evolve to fit God's design. So neither tarry nor hasten the end, tomorrows will come, and you will still be a part.

How and when and why God made the universe, we may never know. He made the universe for His purpose, to His own design, the way He wanted it.

For Lack of a Word

If you think God doesn't have a sense of humor, consider that He allowed the English language. Any competent dictionary has words that have no reason to exist, and here I went and made a new one, “everwhen”. There are words whose meanings describe, in great detail, things that never existed. There is 'dragon', an enormous scaly serpent, with clawed legs, wings and breathing fire. Common word, yet rare of sighting. Troll, goblin, ogre, gnome, imp, or gremlin, seen any lately? Fairy, pixie, elf, brownie, sprite, and leprechaun; not your everyday encounter. These words describe different nothings, and yet we often have to grab a foreign tongue for a common usage. Oy vey!

There are no words to describe . . . so we'll make a new one! The President is over the Department of Treasury that coins new money, and George Bush takes great delight in coining new words. Lexicography (it's in the dictionary) has become a harrowing occupation of late. And yet I cannot find a common word for, uh, oh, the inability to find a word. *Please,* no more acronyms!

Then there are simple words, taking up little space, that have so many nuances and connotations and meanings they could fill this page. Know what I mean, like 'mean'? We need a word for words with too many meanings. But not to be mean, I want to point out the word love.

Perhaps you have heard that the ancient Greeks had several words for love? A difference between the love of fine food, love of a sport, love of country, love of the opposite sex, love of friends and family and love of God. But all of those meanings involve the happiness of the lover, things that make the one who loves happy. I have a love of reading, it makes me happy, usually, or at least sleepy. Perhaps you love Cheese Doodles, perhaps you love them too much. And Goober loved licking my face, hence the name Goober.

There are loves so great that being with the loved one, to hold and cherish, through good or bad, overshadows all else. So deep can a love be that its loss is worse than any other possible loss.

Yet love also describes the affection felt for another so strong that the greatest joy for the lover is the well-being of the one loved. A love so strong that all can be sacrificed in its name. A willingness even to be ignored by the loved one, to grant total freedom without hope of being a part of the loved one's life, to prepare comfort and joy without expectation of thanks. To build a universe with everything the loved one needs to grow, learn, and yes, have loves of their own. Especially, to have loves of their own.

Such a small word, such an enormous gift.

Surely God loves a good joke -- He's played enough of them on me -- but it's the devil who is responsible for puns.

Epilog

It is now time to clean out the overhead storage bin, retrieve your good beliefs, and examine them carefully.

Take these essays as my point of view, but don't dismiss my ramblings until you have looked at my muse from every direction. As you seek your own viewpoint, do not be afraid of going down the wrong path -- that too will add perspective -- and do not be afraid to change directions, to backtrack, to start over again. Do not be afraid to tell me that, once again, I am wrong, but be sure to look from every side, angle, and time before you have convinced yourself. Do not take the words of others as truth until you have given them a critical eye. Test that which has "always been done that way," for it may be the best -- or it may not. Hold no unexamined belief. Then take pride in your argument, when you know you have examined it well. Build your esteem, brick by brick, into a tower that will survive the light of reason and the dark of ignorance. Be only afraid of not trying to see from everywhere and everwhen.

God gave you a brain, the most wonderful and precious of all gifts.

* * * *

Thank You, God, for the ice that covered the walkway last winter. I know I forgot to say thank You as I called it to Your attention then. And thank You for gravity, that played such a roll in that incident. I know that without Your laws, I wouldn't be here to enjoy. Thank you for all the views of creation, all the beauty and pain, all directions, and for time. Thank You for taking care of me and the rest of Your creation, but most of all, thank You for finding a small place in Your universe for me.

Notes

An American Sage

Smile, and the whole world smiles with you; but I often laugh, and nobody else sees the humor. Changing your clock instead of getting up at an earlier time seems very funny to me. To be sure the sun rises earlier in the summer, but I rise early all year. It gives me quiet time to work before you are awake, so go back to sleep, I'll see you this afternoon.

If you think I poked fun at the French, don't. I don't find them funny. Names like St. Mihiel (4,153), Epinal (5,255), Oise-Aisne (6,012), Normandy (9,386) and Meuse-Argonne (14,246) are not funny. These are the names and populations of some of the dozen or so cemeteries for American soldiers in France.

Danger! Math Ahead

That whole thing about math not being a precise science: pay closer attention. Math is a precise science, but it can hide the subtle truths that will bite you if you wish to know the whole and complete answer. If you seek the precise answer, be prepared to wear pocket protectors, eat stale food and live alone in an ivory tower. Otherwise, use math as you would a hammer, saw, or measuring tape: as a tool, to build understanding. Without math you can believe all kinds of stupid ideas, like 1 + 1 is always exactly 2. And if you just cannot stand math, fine, just don't cite numbers, statistics, or probabilities.

And Sergeants Too!

A world without pain is a world without pleasure; a world without punishment is a world without reward; a world without hate is a world without love. That doesn't mean you need to promote the negative side, just that you need to accept it as necessary.

Chatting with Friends

You may not understand it, but if you cannot hear God

talking to you in a universal language, you aren't listening.

The Universe, on Balance

That universe balanced on razor blades ditty? I didn't "discover" God in a book, I "found" Him in a blade of grass. This essay holds an outline, a hint, a peek at the idea that God *can* be proven to exist. Wow. I didn't set out with any ideas about God, no wants, desires, or even curiosity about Him. I didn't set out to prove anything, I just wanted to know. It took decades of study before I came to any conclusion. I was very interested in the nature of time and gravity, and found evidence of God instead. Sometimes I am soooo slow, but I don't "believe" anything easily. The sciences rely on statistics to prove theories, and the statistics for the universe overwhelmingly favor a Grand Overall Design. If you learn all that's needed to make a blade of grass, all the laws of all the sciences, you can put the parts together. Goober taught me that trick.

The Barking of Dogs

Don't waste your time feeling insulted. God doesn't use slurs, and nobody else is good enough to ruin your day that way. I could really use the $29.95 though.

I'm Pro-Peace

War is not a sport where two teams get together, set rules, and play. War is when one team comes uninvited, sets their own rules, and kills anyone who won't play. It's O.K. to object to rules imposed from outside, and to stop those who are attacking.

More Science Yuck

This ties in to Club Stupidity. There are only two kinds of stupid. Those who know they're stupid and those who don't know. In scientific circles, as in most circles, the ones who are absolutely certain are the ones most likely wrong. The best part was omitted; it was getting too hard to read. Current theories suggest that 95% of the universe is made of "dark" matter and "dark" energy. "Dark" means that nobody knows what they are,

not that Darth Vader is winning. No one understands very much of science or the universe. The key: understanding is not necessary for appreciating what we have been given. The best you can do is to learn to live with, and to push, your own limitations. I'm really sorry if this essay was too technical; the point was to teach humility. For if you don't eat humble pie regularly, you are malnourished.

Goober Teaches

Goober really was a smart dog, and he taught me much about being who you are, about keeping a positive attitude, and about unconditional love.

Aren't We All

It seems too easy, but with one discovery we can project that knowledge beyond the bounds that led to enlightenment. We apply rules where they have no bearing. It seems too easy to combine two different sets of rules, ones that really don't relate at our level of vision. When something doesn't sound right, feels wrong, or leaves you with an irritation between your ears, find out why. Look back at yourself to see if you have baggage not properly stowed, wishes that may be in jeopardy, beliefs that are blocking your view. Then move sideways and look again at the problem, and back at yourself. Of course, you may actually find yourself to be insane, but then, aren't we all?

A Wake for Orange

Working hard doesn't always lead to a better answer, but it can always lead to new and unexpected understanding, if we keep our eyes open and unclouded.

Time Travel Made Easy

If you get lost while time traveling, don't worry, time is permanent. This was also a dastardly hard essay, but if you can follow it, it holds the seeds of much wonder. If you're not into science, *please* skip the next paragraph.

O.K., I warned you. Superstring theories don't seem to pay enough attention to the geometry or topology of time as part of the world lines of particles. If indeed a particle is continuous

temporally, hence very long in that dimension, like a fuzzy pipe cleaner, a very fuzzy pipe cleaner, and vibrating, and rotating, looping like a corkscrew, and mass is an artifact of empty space, what changes need be made to current physics? Of course, if time and space aren't continuous, however small the quanta, Katie bar the door. Very funny, Einstein.

Welcome to the Club

If you're going to respect life because it has value, don't forget that potential future life should not be destroyed heedlessly. Everything dies eventually, but no life wants its time stream cut short, before it can know joy and love. And you thought these essays were arranged randomly.

Only One Week

If you want to know the truth, ask God. If His answer is hard to understand, the failing is yours; if you wish a different answer, it will not be granted; if you cannot see His love, the loss is yours. If you want to live forever, you don't understand forever. If you want funny, just tell God how he should change things, then hold your breath until he does. Warning, don't try to be funny while operating heavy machinery.

For Lack of a Word

If you don't understand love, get a dog and learn.

Epilog

So how come I'm sure there is only one God? When have you ever seen something really great come out of a committee?

Fare Thee Well

Perhaps you found this book too terse, too subtle, too convoluted, or perhaps too “scientific” to be enjoyable. That's me. I know it was hard to get through it. Sometimes hard is necessary, and I hope you survived. Some of it was light-hearted and some profound, I switched back and forth to help loosen your neck, to get you ready to look in more directions, to

help you shake off those sticky beliefs. I hope you have re-found your balance. What I don't want you to find is hidden meanings that justify your own dreams, ideas and beliefs. They aren't here. I didn't provide a list of books to support my crazy ideas, I didn't want to steer you to a place from which to see things my way. Find your own.

If you find challenges to your treasures, fine. If you think I have it all wrong, great, prove it to yourself. If you find yourself examining things from sideways, then this is my gift, with love, to you.

Thanks for the biscuit.

Everwhat

This is dedicated to Richard P. Feynman, for the joy he shared.

Trapper Beware

You may wonder why a mechanical engineer would believe himself qualified to write a book such as this. Engineering may seem too dry, too prosaic, or even too unimaginative to be entertaining. How could a discussion of science possibly capture your audience? We engineers have no devices to enhance telekinesis, we have failed at alchemy, we have no magic wands. Instead we design can-openers, calculate springs for car suspensions, and build bridges. We are a visual lot; to make a tool, we must be able to envision it and its task. We have disdain for that which we cannot measure, test, or hold in our hands. Talk about dry -- we like computers. We even build them.

So how can an engineer "believe" in God? We first must learn to use materials according to their properties. We must understand iron, for example, as it is; how strong, how ductile, and how heavy. And we must accept that iron exists. We must look at the universe and learn how it is, how we can use it, what can and cannot be done, and accept that it is as it is. The more we create new tools and discover new laws, the more amazing we find the delicate balance of this universe. Indeed, we are in awe when we start to see this grand design. Of course we believe. Perhaps it is a belief deep inside, perhaps below our everyday occupation, perhaps hidden from view, but it is belief nonetheless. For failure of an engineer to work with things as they are is always spectacular.

I have become bored with fiction, which is certainly devastating to an avid reader. The lack of new ideas, intriguing characters, or unique plots has left me dry. I find more and more pleasure in scientific journals, and more mysteries and wonders there too. I find questions that need undiscovered solutions. I also find more stupidity there, but I'll save that for later. No, the universe before us is filled with more glory than any book. There are truly more things, Horatio, than are dreamt of in our philosophies. So I'm writing another book.

And what of poetry? Can we not set our slide rules aside and enjoy a wild flower? Is climbing a mountain only a function of mass raised over a distance? Is a stroll on the beach

only a chance to calculate the number of grains of sand? I hope that the creation of new music is never mastered by a machine, that beauty is not reduced to numbers and symbols, and that artistic creativity is not relegated to a tool.

Now once again I will set new perspectives before you; posings that might stretch and invigorate your thought, that might build new windows to light and amuse your eyes, so that you might see and feel and hold more of where you live, so that you might enjoy the wonder more.

So, I'm an engineer. I say, "If there is a God, I must set a test for the proof." The details are not important, but I once decided to build a trap, a construct that would be tripped only by an unseen supreme being. Not to hold, certainly not to harm, but to catch a sign that one of the great powers had passed that way. I set the trap and went on about my life. A long time later I went back to check my cleverness only to find the trap undisturbed. When I got home, I found a note etched on my door:

"Do not set a trap for a 6,000 pound bear. You might slow him down, but you will surely make him angry."

White Matter Supremacy Groups

The Galactic Council of Little Use (GCLU) announced today that it has discovered a massive conspiracy by a group or groups of white matter supremacists (WMS) which have been systematically removing or destroying all dark matter within the solar system. Dark matter is essential to the health of our Milky Way galaxy, as it keeps the stars from flying out into empty space, keeping them in their tight orbits.

Dark matter allows stars to orbit the galaxy faster, and has been noted to exist in all nearby and distant galaxies. It literally holds the universe together. Visible matter gravity helps keep the galaxy together too, to a lesser extent, but there is no evidence of malicious activity by the WMS against visible matter.

GCLU scientists discovered the absence of dark matter while conducting their epochal inspection of solar system physics. They couldn't say when the vandalism had occurred, but they issued an immediate alert, saying that only visible matter gravity was left to keep our planets in their orbits around Sol and to keep our populations on their planets. United Galactic spokesthing Yxrglburp said that we didn't notice the loss because we cannot see dark matter, but that the UG would begin discussing emergency shipments of replacement dark matter within the millennium. He suggested that we refrain from jumping up into the air until full gravity is restored.

In an unrelated story, the UG today issued arrest warrants for several individuals wanted in connection with the disappearance of the local system's supply of dark energy.

* * * * *

As scientists observed distant stars in other galaxies, they saw a puzzle. The stars were moving too fast. There does not appear to be enough mass in the galaxies to produce the orbital velocities exhibited by the stars furthest away from us. The speed of a star is calculated based on the red shift of light if it is moving away from us, and the blue shift if it is approaching. The Hubble constant calculates the distance to far galaxies as a

function of their overall red shift, or the elongation of the light waves, based on the speed that the galaxy is moving away from us. That distance allows us to calculate how far a star is from the center of its galaxy, and therefore how fast it should be orbiting. The problem is there only appears to be about one-half as much mass in the galaxy as would be needed to produce the orbital speed scientists observed.

To solve this dilemma, dark matter was proposed. Dark matter is mass that cannot be seen because it doesn't shine with emitted or reflected light. This mass forms an invisible halo around galaxies, providing the extra gravity that speeds up the stars.

Did I miss something? Local measurements of gravity only account for half the gravity of the galaxy. If the dark matter is invisible stars and planets, where are the collisions with the visible ones? Those collisions would be spectacular. No visible encounters, just strange changes as gravity fluctuated. Stellar nebulae would show streaks of gas following the passing gravity. Star systems would suddenly[1] go off in wild directions. Imagine a fair sized dark star passing close to the earth. Talk about changing your day! If we survived at all, it would send us careening out of orbit around the sun, so survive we might, but not for long.

What if there was a nice ring of dark matter around the outside edge of the galaxy instead? It would certainly speed things up, without squashing us bugs here inside. A great invisible cloud of stuff equal to the mass we can see in the Milky Way. A cloud that somehow stays put around the galaxy's outside edge. I suppose that if it were a super dense, solid ring, it might stay in place for a little while, kind of like one of those invisible fences for dogs. Personally, I'd sooner believe in hoards of angels pushing the stars around the heavens. I could be wrong, but lumps of dark matter should be detectable, at least within our arm of our galaxy, by its disturbances of orbits.

If the dark matter was thinly and uniformly distributed throughout our galaxy, it would balance out in any local measurement of gravity. But that would mean that dark matter

[1] Suddenly as in millennia, but noticeable nonetheless.

again stayed in place, was not collected by suns and planets, and was not itself subject to gravitational attraction. Somehow I think that old William of Ockham[2] would cut that idea to shreds with his razor. Either that or we have a really serious problem with the WMS groups.

By the way, don't worry; the UG expects to recover all the missing dark energy.

[2] William of Ockham's proscription that "entities should not be posited unnecessarily" became known as Ockham's Razor, or simply, "keep it simple stupid." It also means that adding extra wild conjectures might make chili spicier, but it spoils the taste of a scientific theory. William was a Franciscan monk and a philosopher, but his 14th century advice should be taught in Physics 101.

Poetry, Yuck!

Is there any difference?
Atheist and devout alike, seeking
Answers, reasons, happiness.
Pulling that unto themselves.

Freedom to do as will,
Or eternity filled with bliss,
Some will give, some do care,
But first unto themselves.

And in a thousand times,
Was this a better place,
Because they came this way,
Or just unto themselves?

The children need not know,
Nor mark I passed this way,
Just once, and for everwhen,
Set unto them, a better day.

* * * * *

I so hate poetry, but this fell out one morning.

Shut Up and Deal

While in college, I worked as a draftsman at a very nice civil engineering firm. At lunch time we would play cards in the lunch room, enjoy our meal, and have a good time telling jokes. We played so many games of cards that I wondered about how many times the deck needed to be shuffled to insure a random deck. Naturally, I decided to find out, to figure the odds. How hard could it be?

With only two cards, there are only two possible arrangements. With three there are six, with four cards there are 24 possibilities. I saw a trend, and drew out charts of all the arrangements up to 5 cards. The number I sought was a product of 1 x 2 x 3 x 4 x 5 . . . all the way to x 52. This was late B.C. (Before Calculators), but I was able to use my slide rule, and came up with 8×10^{67}. A big number, I checked it twice, once by hand. I was very proud not only to have figured out the answer, but also the formula to get the answer. Just to reinforce that large number, I measured a deck of cards, then calculated the size of the pile of decks needed to have a deck shuffled every possible way. It seems the pile would fill the entire known universe. It obviously wouldn't take long to shuffle a deck to a random distribution. So, I double-checked my answer and I was ready.

The next day at lunch I proudly announced to the engineers and staff what I had accomplished. The secretary said, “Oh, that's just 52 factorial.” Guess I must have slept through that class in high school. It was very humbling to have worked so hard to figure out what everyone else in the room already knew. No one laughed, they just weren't impressed. They did say, “Stop shuffling and deal.”

* * * * *

It is difficult to learn when you're stuck behind a rotating mirror. It is especially difficult to learn from people who spoke fluent gibberish half the time. That's what dyslexia feels like sometimes. It's a hurdle, a high hurdle at times, but not a handicap. Learning to overcome the hurdles stretched my

mental muscles, made me stronger, and I hardly notice them now.

I remember only three teachers from high school by name: Mr. Justice, who taught drafting, from whom I learned scientific method; Mr. Millikan, who taught algebra, which I learned and enjoyed somehow; and Mr. Weaver, the biology teacher who secretly taught us how to learn. I cannot remember the teacher who realized in my senior year that I could barely read, and put me in a reading class. My deepest thanks to all of them.

Learning to measure things, to draw them to scale, to orthographically project the third dimension of objects, then to re-check my drawings gave me an insight to true understanding. Guessing the right answer doesn't work. An answer that seems right often isn't. Learning to check my answers was how I was able to fake my way through high school. Learning how to solve problems, how to check answers, and how to learn were the best things taught, and they weren't even classes.

Eventually, I earned my B.S. in mechanical engineering through a four year correspondence course. That got me jobs. It seems I was a rare graduate to have that much perseverance. My third year of calculus without an instructor taught me to avoid a career in mathematics, but I passed the course. By now you might say, "That crazy Stafford only got book learnin', he don't know nothin'." True, but it does make me erudite. The best part of correspondence school is that there's no bell at the end of classes. I never knew when to stop studying. Now when I have to wile away the hours, I need a book, preferably a science book, and I'll either gain knowledge or some needed sleep. Bring on the problems. I've learned how to find answers that are not at the back of the book, and I do so love problems. I'd better; God gives me plenty of them, without my asking.

Anybody Home?

Enrico Fermi had imagination to match his genius. He put a nuclear reactor under the stands of a University of Chicago sports stadium. I love Chicago; it's the only place in the world where they sell great hot dogs. Fermi was responsible for many physics breakthroughs, and for inspiring a remarkable amount of alien chasing. A casual comment at lunch, and tons of hours and years of paper have been spent in pursuit. His casual comment? "Where is everybody?"

He was asking after the myriad of galactic civilizations that should exist. Based on the number of stars in the Milky Way, a certain percentage should have planets suitable for life. Of those planets, life may have evolved on some number of them, then intelligent life on an even lesser number. He postulated that at least one of those intelligent races would develop space travel, and eventually travel throughout the galaxy. Based on the age of the stars, they should be here. Now.

If you want a career in theoretical astronomy, this is the field for you. You can invent your own numbers. How many planets are earth like, how many have life, what percentage have intelligent life, and how many of those aliens are willing to spend many years traveling empty space to get here? You can even invent your own necessary conditions, and then your own percentages to fit those conditions. For instance: what is the probability that the alien society cannot satisfy avid nick-knack collectors, or has some truly obnoxious in-laws to escape? I can promise you that your guesses will be as accurate as any. Short of a 100% guarantee that is.

Travel to the nearest star takes light over four years, so unless the aliens develop some way to break the light speed barrier, they'll need to pack more than a lunch for the trip. All those light years and no Tim Horton's[3] coffee shops. Personally, even if I was immortal, I wouldn't spend several centuries to

[3] As long as I've decided to include footnotes, I thought I'd put one in for my Canadian friends. Besides having the world's freshest coffee, they have the best scallops in Digby, NS, the hottest chicken wings in Kenora, ON, and the world's worst roads in Québec. Canada also has most of the world's best scenery.

visit anybody. Faster-than-light travel is the answer for people with too much time on their hands. Speaking about being in a hurry to get somewhere, I much prefer teleportation; it's much cheaper and just as crazy.

I don't know about the alien home worlds, but if they are diverse enough to spawn that kind of intelligence, they must rival our own selection of exotic locales and peoples. Somehow I doubt that living here for five hundred years would get boring, and it's unlikely to be different on another home world. We even have other planets here for those who cannot find enough adventurous things to do on the weekend. Come on guys, hasn't God put enough mysteries before us, enough wonders to see, enough vistas to discover?

For all those aliens who don't have wanderlust, may I suggest radio broadcasting? They can tell the whole galaxy about their latest improvements in kitchen appliances, fast food, suppositories, you know, and even scientific marvels. And if they broadcast, we are ready to listen. An offshoot of Fermi's Paradox is the SETI project, which consists of all kinds of radios listening for those signals. Personally, I'd like to modify the Search for Extra-Terrestrial Intelligence, expand its scope, broaden its reach, and intensify the search. I propose we start a Search for Terrestrial Intelligence, even though I'm not optimistic of finding any.

Bar Room Chatter

God walks into his favorite pub and sits down at the bar next to his friend, Dog. Joe, the bartender, sets God's favorite brew in front of him while admonishing him to not bring any more brimstone into the premises.

Dog asks what God's been doing today, always a loaded question.

"I have built another universe, one to prove my point to ye," said God.

"And which point would that be?"

"That a universe with enough complexity and diversity will evolve intelligence of its own."

"Would ye be placing a round of drinks in wager?" Dog replied.

"But for sure."

"And how would ye be proving this?" Dog asked, "Being the fair being ye are, ye must have rules, no meddling and such, aye? And what can this intelligence do, to prove itself to be?"

"Would ye receive no observable presence, despite my omnipresence?" God proposed. "As to the task, shall it be that the intelligence should discover the reason for itself? Be that a fair test?"

Dog was pleased. "Aye, and I can give ye me order now if ye like, another round of ambrosia, to be known."

"Then come now, for I have a sight for seeing."

* * * * *

I overheard this story while disinfecting my throat at my favorite bar. It was being told by an elderly priest, apparently to himself and to the line of empty glasses in front of him.

"Father," I asked, "how could we ever prove to God that we are intelligent?"

"Son, we just have. I have found the reason for our being to be just this: that we comprehend that He created us so we would discover that He created us, just to win a bet."

"Then," I replied, "I guess we have done just that."

“Yes, it would seem so.”

“And what reward do we get, Father, or does God have more need of us?”

“Have another drink, Son, I am running a tab.”

“Well thank you, it's getting awfully cold and dark outside.”

* * * * *

Just a little humor to break up the monotony, at least I hope it's just humor. If it's not funny, I'm sure I will be told so.

A Better Business Plan

As a small business owner, I am always looking for a better business plan. I am not a physicist or a philosopher, but rather, I have a small computer store. I do this because no one will pay me to be a physicist or a philosopher. My business motto is, "Take care of the customer, the rest is paperwork." It keeps the kids who work for me off the streets, and little else. It's not much of a plan.

My little town of 10,000 has at least 13 bank branches, not counting branches in grocery stores. If I'm an average customer, that gives each bank about $137.45 in assets. We don't even have 13 pizza places . . . yet. How good of a business plan is that? And these guys are financial geniuses!

I have recently discovered another business with a marvelous plan. It has world-wide distribution, its product is available everywhere, and there has never been a shortage. The product is given out for free, and although its cost of ownership is more than any other, it is almost never turned down. Many people actively seek it, and are more than happy to share it with everyone. Some people simply cannot get enough, and will give up anything to get more. The product? Stupidity.

Yes folks, the Stupidity Unlimited business is booming. It is promoted on TV, the radio, and newspapers. Whole books are devoted to it. As I travel around the country, I find vendors passing out free samples everywhere. There are kiosks in every mall, at every roadway intersection. Why, in Atlanta, they even flood the interstate highways with it. It's widely available in schools: teachers bring it in, and kids bring it from home to share with the class. Paupers can have as much as kings, and kings are not wanting for their share. We even have an inexhaustible supply here in my shop. Why, I'll bet you have more than you'd care to admit. And of course, you can easily download it from the internet.

I have heard of people who are trying to put Stupidity Unlimited out of business, but they will never be able to stem the tide. While great centers of learning try to mop up the spills, there are great spigots there too, and the spigots are wide open. I thought I would stop carrying the product at my store, but the

demand was too high.

I have also heard of people who think they don't have any; I've even met a few. But they also think that they don't get gas, and we know better, don't we? I have yet to meet anyone who doesn't have a good stock of stupidity, but if I ever do, I'll share my own abundant supply with them.

So, I decided to take a part time job at a local stupid factory. I asked around for the nearest one, but all I got was dumb answers. Some unemployed union workers told me that they "don't need no stupid factory around here." Some people said it was grown on farms, but I know they make plenty in corporate boardrooms, too. It's not easy to ask, "Where do you get your stupid?" as the responses usually include pain. I yelled "Hey, Stupid!" in a crowd once, and everyone looked, but I got no help. I went to a town meeting to learn the local stupid regulations, and was told to leave. I wrote my congressman, asking after all the stupid laws he had, and he was down-right rude. I just wanted a job in a successful business. Oh just as well, I hear that Stupidity doesn't pay.

Thesis Gooberis

We would like to welcome the renowned Dr. Hingle Dinglepop, who is joining us today from the Massive Physiks Institute. Please be seated as I read this essay. If you are fond of physics, or at least familiar with the law of gravity, you know you will not wish to be a victim of that law. If, on the other hand, you find the subject boring, you will reduce the risk of injury when you fall asleep.

A conventional visual expression of gravity is a mass, like a bowling ball, sitting on a large slab of foam rubber. The slab is thick enough that the ball doesn't "bottom" out, but rather makes in the rubber a conical depression with a curved cross section, much like the bell of a trumpet. The sides of the cone become steeper the closer they get to the ball, and flatter the further away. The steepness of the sides of the cone, like the intensity of gravity, increases the closer you get to the ball, until you touch the ball. Then gravity actually decreases under the ball until it reaches zero, or flat, directly under the center of the ball.

This visualization agrees very well with the distortion of space and time that occur around large and small masses alike. Einstein accurately described this distortion, and he has been proven correct repeatedly.

If we place a ping pong ball on the slab of rubber near the edge of the cone, it will roll down the cone, gaining speed faster and faster until it hits the bowling ball, where it will eventually come to rest. A marble will make its own small dent in the rubber, but it too will roll down to the bowling ball. If we roll the marble across the flat part of the slab, passing it through the cone, its path will curve toward the bowling ball until either it comes to rest next to the ball or exits the cone and continues on its new way.

We shall now take the bowling ball off the foam rubber and we will drop it on the floor. This will wake the physicists that have fallen asleep from boredom, and it will entertain the non-physicists.

In our previous experiment, the slab of rubber represented, in two dimensions, the three dimensions of space,

and the cone represented distortion in the vicinity of a mass. A good learning tool, but it makes mass look like another dimension, at right angles to space and time. The marble rolling down to the bowling ball actually used gravity to define gravity. It also made for a very difficult visualization within three, much less four, dimensions. It's definitely time to drop the bowling ball, but we will keep the foam rubber. Please excuse me while I draw some random dots and straight lines crisscrossing the slab.

I now propose to represent the distortion, local stretching of time and space, by pinching the foam rubber. I shall secure the pinched-up part with a small string, which will hold it tightly and densely compressed for the rest of this essay. The small string may already be familiar to some of the physicists, but I will describe the string later. I shall now step back so that you may crowd around and see the effects. The foam rubber is stretched the most close to the pinch, and less far away. Dots drawn on the slab have been pulled closer to the pinch; the straight lines near the pinch have been curved toward the pinch. If the pinch was inside the slab, it would be a great representation of the distortion of three dimensional space at a single instant in time, but harder to see.

I will now pinch another spot close to the first, and secure it with another piece of string. Now you see that the new pinch also distorts the foam rubber like the first, and the two pinches pull toward each other. Eventually the two pinches will move together, as the tension difference pulls them. This is a fair representation of the attraction of gravity and the distortion of space, all without bowling balls, ping pong balls, or marbles. Just those little pieces of string.

Please return to your seats as I cut the second string, releasing the second pinch. Did you note the interesting 'pop' as I turned that mass loose?

Now we have only one pinch, but we are not through yet. Observe the wrinkles in the foam rubber as I twist this pinch, see how it resists twisting, by dragging foam rubber with it. See the foam rubber stretch as I push the pinch sideways; this time it's resisting change of position. Those were rather nice representations of inertia. They go well with the representation

of gravity, don't they? Would someone please help Dr. Hingle Dinglepop get back up in his chair?

* * * * *

While working on this theory, I tried to determine how much space was curled up inside the pinch. The masses of the subatomic particles were well known, so I figured I could calculate the volume of empty space based on its mass density. Interesting numbers abound on that subject. Most every source agrees that "empty" space has some mass, but I could not find any direct measurements. Good arguments can be found about this mass, but the results range from zero to 10^{-30}, to 10^{93} gm/cc and beyond. Those numbers aren't very useful for calculations. Using the value observed in the galaxies, 10^{-30}, a single proton represents 1.67 cubic meters of empty space. Huh? The large 10^{93} number makes a proton look like a hole in the background mass. Using the value observed in the solar system, 2×10^{-17}, gave a much more reasonable volume, but my confidence in this approach was already shattered. All protons, here and in a galaxy far, far away weigh basically the same, so the mass value of pinched space must be the same everywhere.

Trying to find some mass in a vacuum is an interesting adventure. Those little particle/anti-particle loops won't hold still. I almost fell out of my chair when I realized I should use the *elasticity* of vacuum instead. Fortunately, I never asked anyone for that value, saving what little face I have left.

Finally, I realized that I only needed the elasticity of space itself. That's easy; it's Sir Isaac Newton's inverse square law, which Einstein refined 90 years ago. The stretching is very small for a proton, for all the atomic particles, but the formula might still fit. The vibration of the particles begins to look like Jell-o shaking, which may lead to the stretched field vibrating along with it. If only I could remember where I left my subatomic gravimeter.[4]

Suddenly, I didn't need to think of a particle as having mass at all. All I needed was for particles to pinch space into

[4] Yes, this is a footnote, it is also a description of a possible experiment that should be a lot of fun.

tiny “balls”, thereby stretching the surrounding space, which looked just like gravity *and* inertia. Whew! Space can be stretched, so I assume it must be compressible too. A particle isn't a “marble.” It has no “mass” or “weight;” those are artifacts of the stretching of space. Measuring gravity or measuring inertia is really only measuring the stretch marks. No, perhaps a particle is like a string; a very thin, very strong, temporally very long string. A string suitable for wrapping around and holding compressed space.

* * * * *

The concept of a moving particle dragging its stretched space with it doesn't seem out of line; the stretched space has no mass. Wait a minute, if mass can drag space with it, is the Michelson-Morley[5] experiment still valid? How much of the stretched space is moved? Does moving stretched space stretch the space more?

We should not think of the foam rubber as if it is the ether; all we really need is the warping of empty space as defined by general relativity. The foam rubber is just a visual tool. Space is three dimensions; matter isn't. It's not correct to think of gravity like a screen door spring. A coil spring exerts the same force from end to end, not $1/r^2$, varying in strength as the radius r, the distance from the end, changes. Until now, I thought that I could observe the strength of a field decreasing with distance as the surface area of a sphere increases, as the force spread over an ever-widening area. But the only observable, or measurable, force for gravity is between to masses, two objects. How would we measure the gravitation between a mass and nothing?

How indeed? The acceleration of gravity pulling two objects together is easy to measure, and its measurement has been calculated to many decimal places. But there seems to be no way to measure the acceleration effect gravity has on the

[5] For those unfamiliar with the M & M experiment, it was a clever arrangement of a light source, mirrors, and a detector, intended to find the ether that light waves propagated through. Rotating the apparatus as the earth moved through space detected no effects, indicating that there is no ether.

empty space that surrounds the objects. No way to know if this effect even exists.

And what of inertia? It seems an easy concept to measure inertia. Just see how much force is required to move a mass. Sounds easy, but the details actually make inertia harder to measure than gravity. Nonetheless, it has been measured, and so far, the numbers seem to exactly match those of gravity, currently to one part in 10^{-12}. What a coincidence, unless inertia and gravity are the same thing. Ockham's Razor again cuts into an issue.

It's convenient to think of gravitons as the vector for gravity. As they spread out from a mass, they attract any other mass they encounter. This begs for the number that represents a single graviton: how much acceleration does a single graviton exert? The parallels to photons, known to exist, known to be a force, known to be in quanta, make a strong case for the gravitons that follow the same inverse square law. But how do gravitons display properties for inertia? An individual graviton would act like a coil spring in tension, pulling together two masses. For a graviton to exhibit the property of inertia, two would be required, each one pulling equally from opposite directions. Acceleration would stretch the graviton opposing the direction of movement, with the opposite graviton helping the acceleration. That makes sense to an engineer, until he asks where the other end of the graviton is anchored. It looks like most gravitons just go off into empty space, never encountering another mass.

Suddenly, the concept of space itself being a flexible medium rears its ugly head. It does seem like an ether, an ether that is pulled around by a mass, or a group of masses, happily going along with a non-accelerating object, but resisting change. Perhaps the visual tool of foam rubber is not so bad, as long as the foam rubber is very soft, not dense, and almost a vacuum.

The equivalence of gravity and inertia seems too obvious, moving space around with “mass,” but I don't like the idea of tearing space. Perhaps there is a seed here for the various masses of the particles though. The differences in mass would relate to the volume compressed by the string. A proton on Alpha Centauri is indistinguishable from one in my pocket,

so they must both be made of quarks that are the same, albeit very small, strings.

At first glance this visualization allows for particles of negative mass, a popular if unsupported idea. To visualize these particles, just insert two pins side by side into the foam, and then pull them apart, stretching the space between. But as you do so, two condensed spots appear on the outer sides of the pins, and releasing the pins pops them back together. Oh well.

* * * * *

Now I wonder what I did wrong, why something so obvious to me doesn't seem to be the common knowledge. Have I merely restated the obvious, have I simply defined mass and gravity in terms of mass and gravity? The link between gravity and inertia, long sought after, measured to many matching decimal places, becomes obvious: they are just two words for the same thing. My sincere apologies, if I'm right, to those who are hunting gravitons.

This theory is just a visual tool to describe how gravity and inertia are the same, not an explanation of why. Just in case I'm proven wrong, I'm glad to say that my dog, Goober, came up with this theory. He's a very smart dog, but is after all, just a dog. He did have me run an experiment in the garage to show me his evidence.

The experiment involved using a laser, filtered to a pin point, passing through one slit of a double slit screen. When the second, 'unused' slit was present, the beam created an interference pattern on the target, but not when the second slit was absent. This apparatus led to many colorful words and phrases as I tried to make the experiment repeatable. A dusty garage is not a good lab (and a bouncing dog is a poor assistant) for very small precision measurements. Goober said that was OK, that the experiment was really just a change of perspective of other single photon experiments where the experimenter didn't know which slit the photon had passed through. I knew which slit, and still I got an interference pattern.

Goober explained that the spatial distortion around the

photons was like a field. Perhaps the fields of the photons, as they passed through the field of the screen, were deflected by the distortion caused by the offset hole in the screen's own field, that the interference was actually setup inside the first slit. He said something about the photons wobbling as they corkscrewed through a distorted field. Where does he come up with this stuff? He also stated that this is his second field theory[6]

[6] His first field theory is that it's easier to chase rabbits in an open field.

Cleaning Out Closets

Dreams can have a big impact. I woke the other day from a disturbing one. The dream had shown me a proof that the earth is hollow. Hey, I didn't promise you that this book made sense. I know where the dream came from; I had been plotting the gravitational pull above and below the earth's surface. Some people like to go bowling, I like to sit and think about bowling balls. Not really, but I do so love problems. The force of gravity diminishes as you rise higher above the earth's surface, and also lessens as you go deeper below. Earth's gravitational pull actually falls to zero at the center of the earth. Anything exactly at the center is in free fall, with the earth's mass pulling equally from all sides. Kinda. Actually the Earth and the Moon orbit around each other, as they orbit the sun. The center of the orbit of the Earth-Moon pair is the center of mass of the pair. That point actually lies inside the earth, less than a thousand miles below the surface. All of those centers of gravity twirling around each other could easily move the material inside the earth, maybe even pushing it out toward the surface, making the earth hollow. This paragraph should be a warning to you: bad things can happen before I have my morning cup of coffee!

With absolutely no apologies to the Hollow Earth Society, this is why I seldom eat pizza before bedtime. This idea got almost an hour of my consideration. That's how long it takes me to get up, shave, shower and get to work where the coffee is. The whole hollow earth notion is based on the concept that the earth is made of a solid material, hence can be formed – exactly how, they don't explain[7] – into a hollow shell. Slight problem: the earth is mostly liquid. I know, I've seen pictures of it leaking. The core of the earth is actually like a ball of hot soup, slowly stirred by the tides, and it's a lousy place to set up a secret society. Bowling balls are solid inside, but perhaps the moon is hollow. It is a little light for its size.

Gravity is not an important force deep inside the earth, but pressure caused by gravity is. The weight of the surface

[7] I didn't explain it either. The idea of twirling masses doesn't have nearly enough force.

bears down on the interior, forcing everything toward the center. Continents push down, mountains push down, even bowling balls push the material below them toward the center of the earth. To make a shell, like an arch, strong enough to withstand that pressure, an arch without holes or gaps, requires some interesting dreaming.

This essay is not intended to make fun of the hollow earthers or of bowlers. It's a lesson for everyone. A simple fact of nature will wreck the best of ideas. Coming up with proof for your position is just the beginning. Stopping your brain when you have "proof" will leave you standing still when the truth comes crashing along. The most beautifully constructed theory, thousands of pages of supporting data, and impeccable logic will all turn to dust without critiques. Wild dreams of magic wands and mystic powers might have entertainment value, but please don't bring them out of the closet without solid, non-anecdotal, reproducible evidence. We have enough craziness in reality as it is, thank you.

This should also be a lesson not to stay out late at the bowling alley, eating pizza and drinking beer with your friends. And it's also not a good idea to store a bowling ball on the top shelf of a closet.

Reality Check

If I filled this book with every formula, repeated every proven theory, and listed each and every known axiom, I would have told you a little about how the universe works. A little how, and no why.

We know that the sun appears to rise because the earth rotates. We know that the seasons change because the earth's axis is tilted and its orbit about the sun is elliptical. We can describe the solar system's path through the galaxy. We even have good evidence that the stuff the earth is made of came from the explosion of massive stars long, long ago elsewhere in our galaxy.

We know photons vibrate at differing speeds to make colors. We know that electrons circle around the edges of atoms, interacting with photons in accurately repeatable ways. We know that atoms interact via electrons in predictable ways to make all the chemical compounds. And we know that chemical compounds can be assembled into everything we see, even ourselves.

We know lots and lots of how things happen, large and small, yet not a single why. None of what we know do we know perfectly, and we know that our knowledge is imperfect. About the only thing we know for sure is that we don't know anything for sure.

Enough already! What we *can* see is marvelous. We can see at least four forces of nature in perfect balance. We can see subatomic particles behaving in predictable, even if only probable, ways. We can see planets and stars and galaxies swirling and gliding to the places we knew they were going. We can see sunsets of unlimited colors, and listen to music made from string and wood and brass. We can see beauty in winter's snow, in spring's sounds, in autumn's smells, and in the feeling of summer's warmth.

Yet we cannot see why these things are as they are.

We can see life being born, growing and dying, and see it repeat over and over again, changing, evolving, adapting . . . bees and flowers, trees and birds, and people, all following some scheme that we cannot fathom.

* * * * *

Why then are some people so sure that God doesn't exist, and some so sure that He does? Why do atheists not marvel at a butterfly's design? Why do religious leaders shun scientific evidence? And why are scientists afraid to acknowledge the evidence that God exists, even though the best of them acknowledge they have no understanding of why things are as they are?

Are we to only trust in that which we know for sure, even as we know naught? Can we accept a design we can't know? Can we just be thankful for all the things that we find, for all the things that allow us to be?

Can we put those things we don't understand in the hands of God, and smile?

The Life and Times of a Photon

or, A Little Light Humor

In order to become comfortable with quantum electrodynamics, you must first become comfortable with being uncomfortable. No large model can be made for demonstrating QED. Classical mechanics has little true meaning for very small scales, say the size of a photon. Things that small do not behave in the way a stick and ball game does. Instead, there is only a probability of some event occurring, not a certainty. If you swing a golf club and hit a ball, it is certain to . . . uh, bad example. If you hit a croquet ball with a mallet, the ball will follow a given predictable path. A photon will only probably follow a given path. With a croquet ball, you can watch the ball travel over its predicted path, and know which path it took. With a photon, you cannot watch, and cannot know which path it took. Croquet balls are solid, and remain so as they travel. Photons are not solid; they travel as waves, and their wave length defines the color of light. When a photon hits a piece of glass, it doesn't slow down. It stops, and a new photon resumes the journey, probably in the same direction, but possibly in another, if it is reflected. When a croquet ball hits a piece of glass, you're swinging your mallet too hard.

For all of a photon's unpredictable flight, it *is* fast. From the moon to the earth in less than two seconds. At that speed, more strange things happen. Time and distance get compacted. To the photon, the trip takes no time and no distance. Remember those waves I mentioned? Those waves are the very nature of a photon, and those waves are very, very small. Without boring you with the math, the number of times a photon vibrates on its journey from the moon to the earth is about 5.1 gazillion, more or less, depending on its color. A photon makes all those waves in no time and no space, as far as the photon knows. What a wonder. Of all the possible universes, we live in one that's full of nonsense. Why do little things stretch the imagination so far?

* * * * *

The sun regularly sends out rays of light that smack the moon, but today one of the sunbeams struck an electron that sent out our little photon to the earth. He was sitting there on the moon, having fun with his friends, and *pow*, he's inside some desperate golfer's eyeball. Desperate to play golf by the light of the full moon, the golfer takes time out from searching for his ball to gaze at the moon. Just as he looks up, our little photon plows into the back of his eye.

So the golfer strikes up a conversation with our photon, "Wow, you made that trip in a hurry! Did you or your friends happen to see my ball on your journey?"

"Trip? I didn't take a trip," our little buddy says, "I was just getting comfortable. But why are you playing golf on the moon?"

Soggy Gifts

If you live in an arid region or a swampy area, you probably have differing feelings about water. Droughts and floods are surely problems involving water, but perhaps you haven't learned the nicer sides of this simple and common chemical compound.

Chemists call water the universal solvent; it will dissolve anything. Even glass, though it has to soak for a very long time. Water dissolves all kinds of compounds that are necessary for life, makes it easy to move them to where they're needed, and makes it easy to remove other compounds that aren't wanted. And who, besides Stinky Peterson, doesn't know that water is the prime solvent for washing and bathing?

You probably know that water is a lubricant, or you'll learn it when you slam on the brakes on a wet road. Water's the lubricant that allows your joints to move. Clean water can lubricate your whistle. Add a little alcohol and it can lubricate your tongue, but perhaps that's not always a good thing.

Water evaporates easily, and that's why it is such a good coolant. Even if you live where it never gets hot, water is essential to regulate your body heat as you exercise. And water is the second most active agent in controlling the earth's temperature, after the sun. From clouds to rain to rainbows, it's all there, in one simple molecule.

Ice shows one of water's unusual properties: frozen water floats. Ice is also an insulator. If you ice skate, you'll appreciate that ice floats on top of the pond, but you may doubt that it insulates when you land sitting. Ice insulates the water below, rather than sinking, which would cause the pond to freeze solid. 'So?' you ask. Well, if frozen water sank, it would stay frozen a very long time, depleting the water supply. If ice sank, life in the pond would be immobilized or die. If ice weren't a floating insulator, the food chain would collapse. Ah, that got your attention.

Another of water's unusual properties was mentioned earlier: its molecular shape. The 104.45º angle between the two hydrogen atoms is not only responsible for ice floating, it's pretty too. Pretty as a snowflake.

And water can be a source of mystery too; how come bottled water is more expensive than soda pop?

Isn't it amazing, that so much depends on the unique properties of water? A simple compound indeed, and thankfully a common one.

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Next, a word from our sponsor, but first a little background on the word sponsor. Webster's first and second definitions define 'sponsor' as 'one who undertakes or assumes responsibility for another.' The third definition of 'sponsor' is 'a person or an organization that pays for or plans and carries out a project or activity.' That sounds like a nice "one" to get to know. So now our sponsor:

"I am that I am, and what I am is getting tired of all your whining and begging and complaining. I give you water, and still you complain. I give you earth, so you can have a home, and yet you want more. I give you life, and you don't respect it. I give you heaven, now stop giving each other hell."

Tests and Measures

And how do we measure love? It has been suggested that a theory that cannot be tested, that has no measurable evidence, cannot be of use. No formula, no mathematical construct, not even a derived constant can be used without a measure. What materials do we use to bridge disparate cultures? What units of length are used to describe the gulf between ideas? And as heavy as a thought may be, how much load does it impose? So we set such things aside, spend no time in contemplation and consideration as we build our knowledge and understanding.

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"An engineer can do for 50 cents what any fool can do for a dollar," was taught to me as the soul of good design. Test the strengths of concrete and steel, measure the width of the stream, learn the weight of the heaviest load, and we can design and build a bridge to carry that load to the far bank. As experience accrues, the quantity of steel and stone can be economized, leaving only that which is necessary to be a bridge. Any fool can fill a river with stone and rubble to reach the other side, given enough stone, rubble, and time. A well-designed bridge will carry the traffic without destroying the flow of the river, will be miserly in its use of time and material, and will survive the occasional load without falling. A well-designed bridge will also be pleasing to the eye, will have grace and beauty to delight those passing that way.

So then, how shall we build a universe to support life and carry it across the river? We will need tests and measures so we can design with economy, balance, and elegance. We shall need space to build in, material to build with, and power to move that material. And certainly we shall need vision, to see where our goal rests. We must leave the concept of infinity out of our design. Physicists and engineers don't like infinity; it breaks things. Let us begin then, and we shall learn along the way.

Space to fit our construct must be large, expandable, and

of many dimensions. One such space should do nicely. Next, the materials. They should be small and uniform, but with enough features that we may build many differing things as needed. Let's make them very small, economical, and easy to manipulate. We can weave the smallest parts together into building blocks for large structures, with a small amount of very strong glue to maintain integrity. Next, we will brew up a force or two to act on those building blocks. These forces must be stable enough for continued use. We shall make them as fast as light, so we can suspend the blocks in an ever-swirling stew of flavors and colors. We shall add just a pinch of gravity to keep the parts from flying away as we build even bigger and more sophisticated assemblies.

Now we have figured out what we need to build a material universe, and as yet we have no idea how to do this. This plan has already taken much study, and we're not even half done. Once we have made all the chemicals and molecules, we have to supply a spark to begin life, no easy task. That life must be hardy, yet fragile enough to change, rearranging and reproducing itself to greater complexity and ingenuity and intelligence. We can make a wide diversity of life and beings; this will allow them to learn from each other and from their surroundings. We have to infuse our little beings with a spark of desire, so that they will want to travel across our bridge. We must give them free will, so that they can find their own way to travel. Finally, we will let them learn wisdom to be their guardrail, so they don't fall off the sides of the bridge.

There is still more to do. We must now infuse our universe with humor, beauty, grace, and love. We will give our beings humor to lighten the loads that they carry. We can give them beautiful things to warm their hearts amid their drudgery. We must let them learn the skill of walking with graceful steps upon the bridge. And we must give them the ability to love, so that they may enjoy their trip. Almost done, and we have yet to divine our ultimate destination on the far shore. We know what kinds of things that must be done, but still we are ignorant of how to do any of them, and oblivious as to why.

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Now you ask, “OK Dave, you have some strange ideas about science, but why did you have to bring up God? Why did you try to tie divine help to an engineering job?”

Because an engineer, too, can appreciate great works.

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All of this seems a daunting amount of work, and to what end? We have labored, and our bridge reaches beyond our ken, perhaps to infinity. Now we must measure that which is boundless? If we cannot measure infinity, how then are we to measure love?

It is beyond measure, the love God must have for us, to do all of this for us. His patience with our searching must also approach infinity. We are only starting to see our universe and its beauty, only starting to appreciate its balance and grace, only starting to marvel at its wonders. Perhaps some thanks are in order.

God chose to make this universe, not to my purpose, not to your purpose, but to His own purpose. That His purpose allows us to study and learn does not mean He has to teach it all to us. That His purpose allows us free will does not mean He must allow us to interfere with His plans. It's His universe; we need first to be thankful that He lovingly made us a part of it.

And what measure will we owe Him, when at last He shows us why?

The Last Poetry, I Promise

Soon again you will stand
where the roads intertwine,
then all too soon you'll ascend
and see the roads left untrod,
and perhaps you'll rejoice
for all that might have been.

The path you mark will lure
many more who walk behind,
for choices made will echo
forever across all time,
and perhaps heavens will cry
for all that might have been.

Then at the road's wayside
you will rest with your honor,
that being all you will have
as your following passes by,
perhaps to sing, perhaps to cry
for all that might have been.

Everwhy

This is dedicated to my best friend.

Remembrance

"Can he see us, Grandfather?"
"No, Breezy, he cannot see us, but he can talk to us."
"It looks like he can see us."

"*So, little ones, you have come to see me again. I am so glad you have come to this forest. It is so lovely this fall, and I don't know what's to become of it. The sumacs are such a brilliant scarlet over by the pale tan beeches; and behind you are the maples, their greens and oranges and yellows are such a delight to my tired old eyes. The smell of the fire and the woods, the crisp air; it is a day of rare beauty. I'm sorry that I don't know your names, but you can sit on that log over there and I will tell you the tale of us.*

"Yes, I am the last. I have searched the Forum and the Archive. I have even traveled to Great Hall, and there is no new record of another. I have not seen or talked to anyone for nearly a hundred years. Shillee was the last one I talked to, and she was in Europe then, but I can find nothing of her now.

"Now, stay out of the fire. I'm letting it die down, but there are hot embers under the ash, and I don't want you to singe your pretty fur."

"You said he can't see us. How does he know we have fur? He doesn't have any. Are they all like that? He looks so strange."
"Shush, and listen."

The old man used a short stick to stir the fire, and then poked the stick into the ground to douse its smoldering end. He did not look old until he looked up and his weary eyes betrayed him. He could have been in his twenties otherwise, instead of his seven-plus centuries.

"Archive tells me this is the last window still alive, and that the satellites are falling, so this may be my last conversation with you. The Forum has gone silent for a lack of voices, but Archive tells me they both will be running for many more centuries. Archive is the only voice I can hear, and when

the last satellite falls, I shall be alone.

"I have cleaned as much as I can, everywhere I can reach on foot at least, yet time will erase whatever I miss. We have left some trash on the moon with Archive. It will last a very long time, but I haven't been there in a great while and shall not return. I have tried to cure the scars of our passing, but our mistake will endure.

"So, I will say a little of us. Archive can tell you so much more, but its voice is dry and without wonder. We covered the earth and beyond with our footprints. We cheated death from everything but accidents. We built Forum and Archive: Forum to keep the peace for all these centuries, Archive to keep our memories alive and healthy. We blended and bent the plants and animals to our needs, needs we don't remember now. We became one big community at peace with ourselves and with nature; we did so much. Our mistake was to forget our children, and now it is too late, for all the women have long ago gone barren, and soon we will be forgotten too. We conquered the sciences to lighten our needs, but so much is still to be learned, and now only I am left to finish the cleanup and to turn off the lights.

"If you travel south to the beaches, you will find me there."

"Can we go see him, Grandfather? He sounds lonely."

"Dear Breezy, he has been gone for millions of years."

"Then how am I going to learn anything from him?"

"It is the Archive that you must study now, so that you may learn before you make your adult passage. You may learn of numbers or tools or healing as you wish, but it's the spirit of the ancient ones that is the lesson. The joy in their songs, their science and their deeds will teach you also of their sorrow and their end.

"They saw their share of life, and to them, that share was not enough. They took more and more for their own life, casting their children's lives aside. They learned how to live a thousand years, but they never learned the meaning of life."