

Wind Sucks. It Doesn't Blow.  
And Other Insights from Buckminster Fuller

by Pete Chasar

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When I first read Buckminster Fuller in the late 1960s, I was intrigued by his comprehensive insights on evolution, history, technology and what he called "Universe." Many years later I wrote a manuscript that explained Bucky's concepts without his rambling and sometimes-convoluted language. According to his assistant, Bucky read the manuscript and, despite its simplicity, was impressed with my "attention and faithfulness to detail."

Recently, I pulled the manuscript out of the drawer where I had stashed it 30 years earlier. Though Bucky's insights go back half a century, they're still refreshing and relevant.

—Pete Chasar

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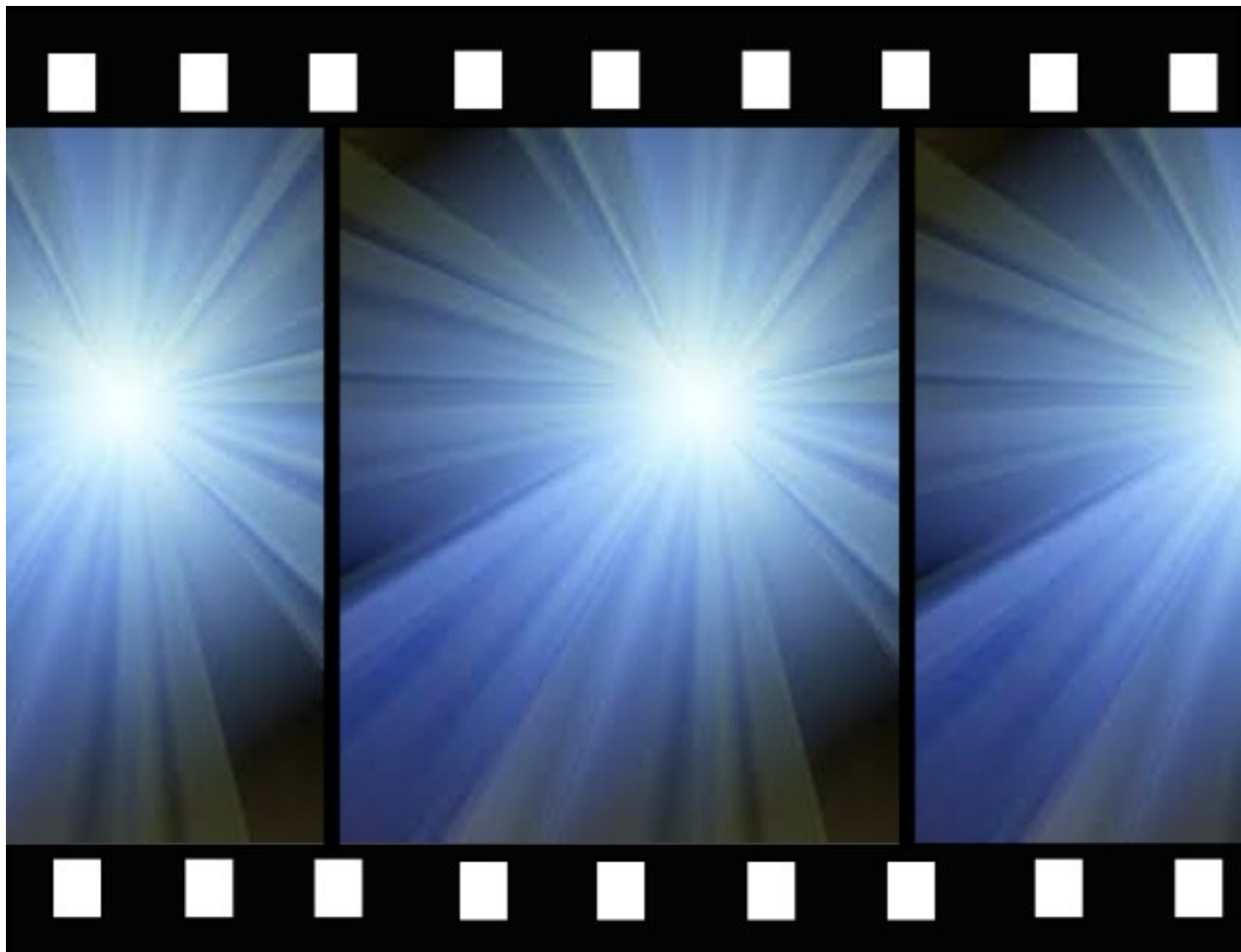
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NO INSTANT UNIVERSE OR PUDDING

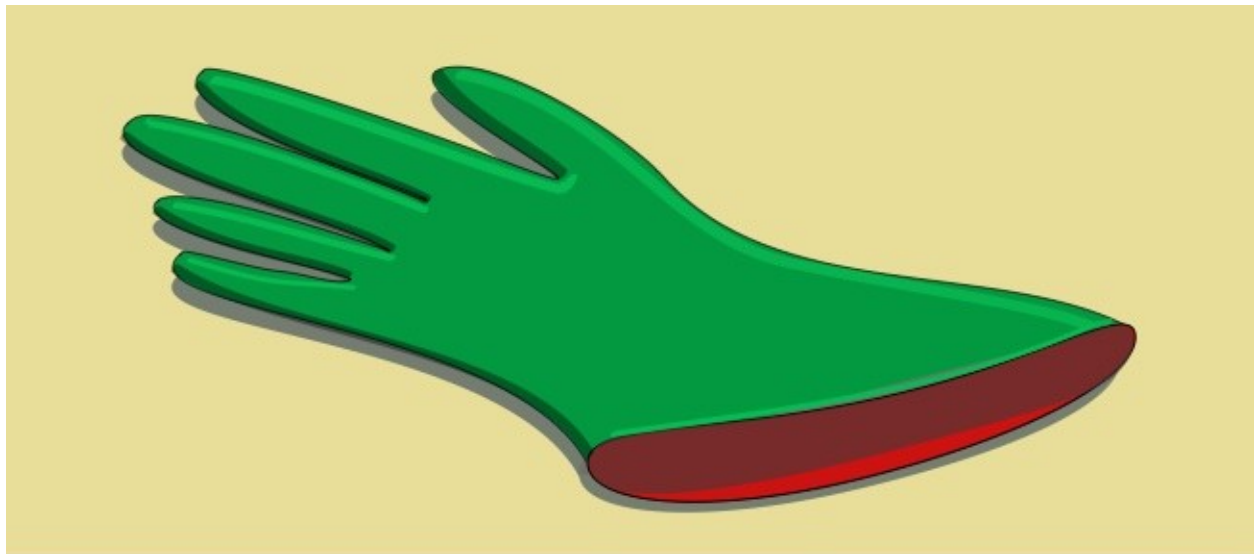
Instant seems to be one of today's most popular words. But, with the exception of thought, nothing is really instant, not even light.

That was proven early in the twentieth century when scientists discovered that radiation (light) travels at 186,000 miles per second. This means that the sunlight now striking your skin or entering your eyes actually left the Sun eight minutes ago, and that the stars you can see tonight could have disappeared thousands of years ago.

It also means that statements like, "I wonder what's outside the Universe" are ridiculous. Universe is not a thing or a shape that you can get out of. Universe is a scenario.

Just as a single frame of motion picture film doesn't tell the whole story, a single picture doesn't describe Universe. It's always changing, and only a small portion of it can ever be experienced at one time.

In addition, a "big bang" creation of Universe with nothing before it is absurd. That would be instant creation. Instead, Universe alternates between vast cycles of expansion and contraction.



#### THE DISAPPEARING RUBBER GLOVE

In Universe there is really no left and right, only convex and concave. This can be proven with a colored rubber glove.

When it's on a left hand, the outside of the rubber glove is red and the inside is green.

However, that left rubber glove can be stripped off so that red is inside and green outside. And now it fits the right hand.

Of course we can bring back the left glove by merely stripping off the right glove. But now the right glove has disappeared. Or has it?

Both exist, but not simultaneously. For the left glove to exist, the right must become a non-conceptual concave glove. And vice versa for the right glove to exist.

What we call space, what we call the invisible, is just the inside-out of the visible.



#### SHORTEST DISTANCE—NOT A STRAIGHT LINE.

The idea of the straight line as taught in high school geometry is just that—an idea, something that can be imagined but doesn't really exist,

Even light doesn't travel in a straight line. For instance, it takes eight minutes for the Sun's light to reach Earth. So, when we see the last small segment of Sun over the horizon at day's end, the Sun is no longer there. You're seeing it around the horizon.

This is what Einstein referred to as "curved space." In curved space, geodesic lines are the shortest distance between two events.

A hunter's gun and a flying object represent two events that can be joined by geodesic lines. If the hunter fires where he sees the object, he misses. He must fire where he thinks the object will be, also allowing for the curving path of the bullet caused by Earth's gravity. Nighttime films

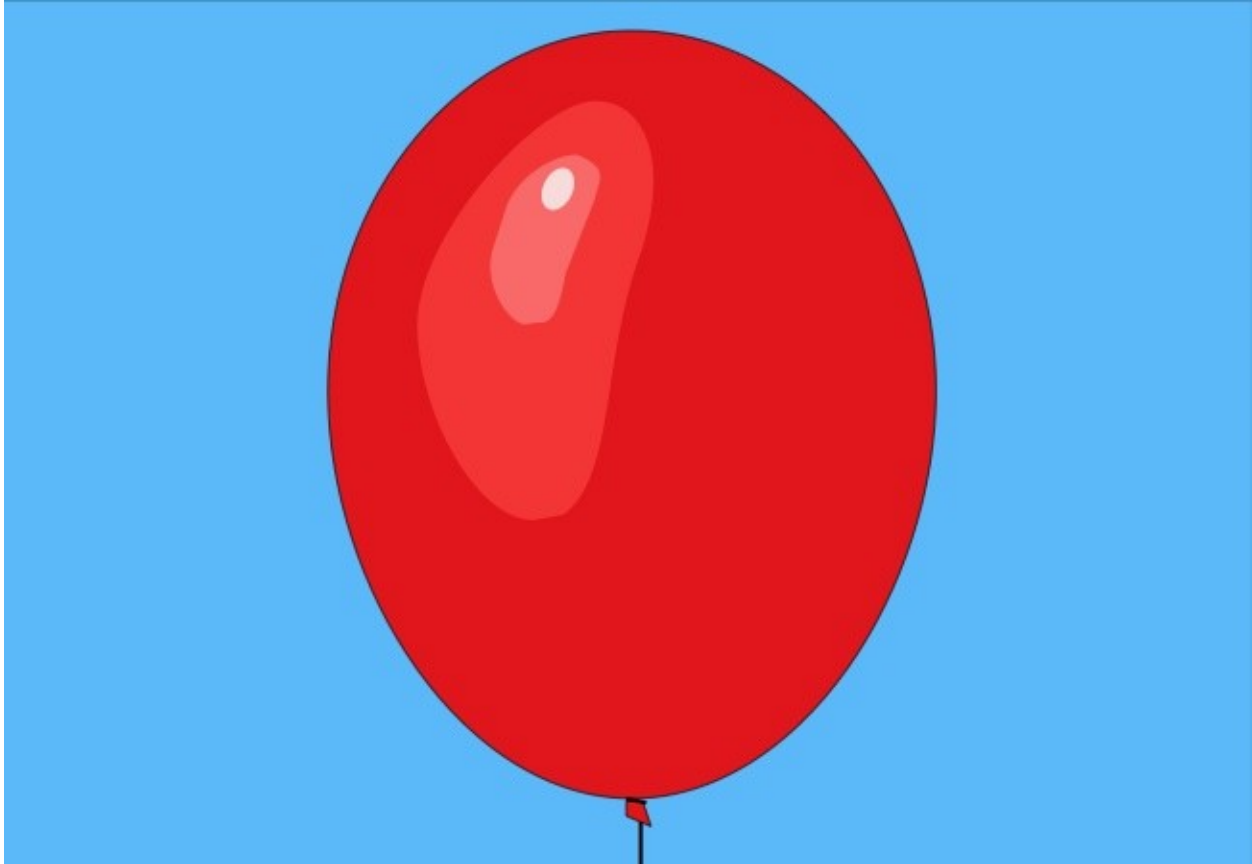
of warplanes firing tracer bullets clearly show cork-screwing geodesic lines between gun and flying object.



LIFE IS BUT A DREAM.

Nuclear physics has found that for every positively weighted particle there's a negatively weighted counterpart behavior. This means that all the positives and all the negatives of physical Universe combined add up to zero. Or, as an old song says:

Row, row, row your boat  
gently down the stream.  
Merrily, merrily, merrily, merrily.  
Life is but a dream.



## YOU'RE NOT ON SOLID GROUND.

As a matter of fact, nothing that you see or touch is solid, whether it's a piece of steel, a tree, or your own body.

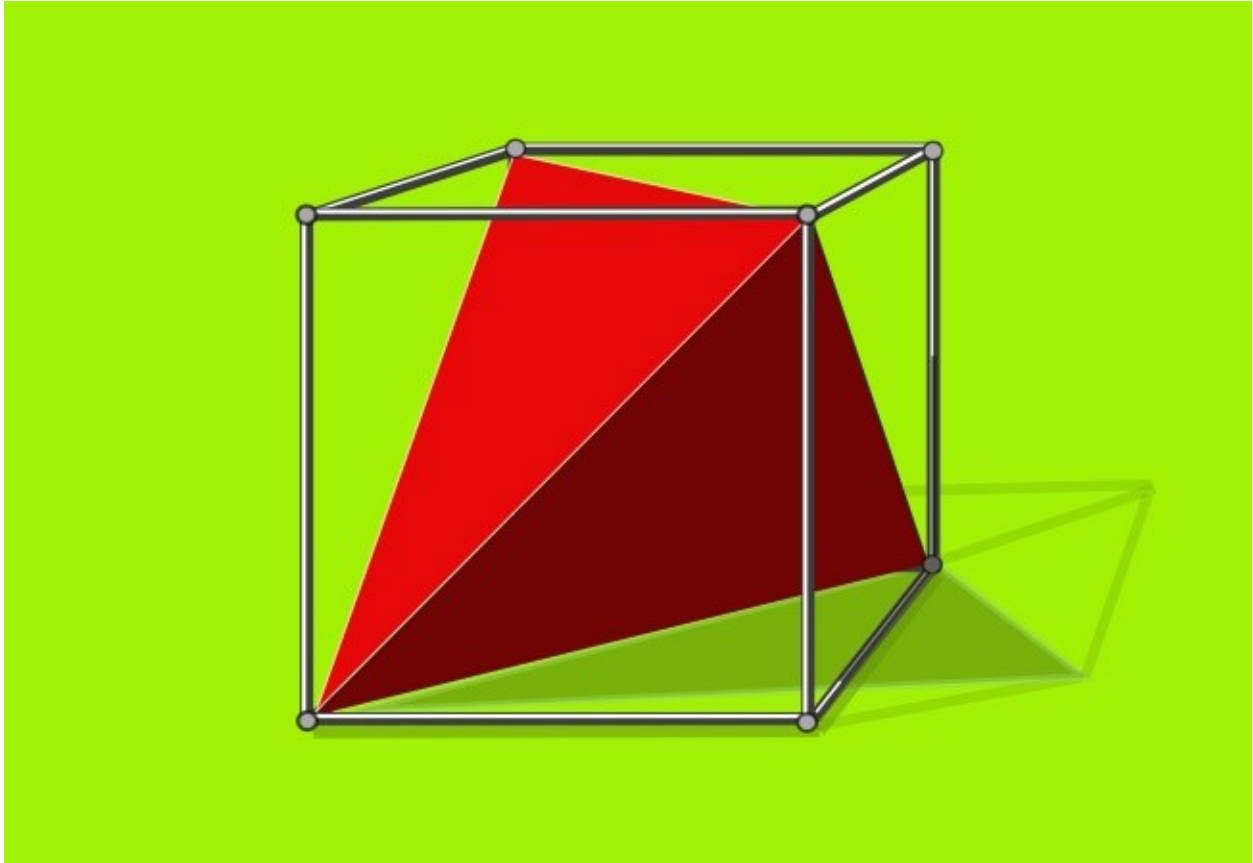
When you touch something that feels solid, what you're really experiencing is billions of electromagnetic energy events, events moving so fast that they give the impression of being solid.

In this non-solid electromagnetic reality, not even atoms touch one another. In fact, the nuclei of the atoms and their orbiting electrons are proportionally as far from each other as our Sun and its orbiting planets.

Mass attraction between the atoms is what keeps everything together (and gives us the illusion of solidity). The same kind of mass attraction keeps together our Earth and moon and our Milky Way Galaxy with its flying formation of 100 billion stars.

Because some atoms fly in tighter formations than others, they give an even greater illusion of solidity. Rubber atoms fly in tighter formation than air atoms for example. That's why rubber

tires or balloons keep air molecules from escaping. The rubber atoms form a fishnet-like grid. Though the grid is full of holes, those holes are too small for the air to fly through.



**NATURE IS NO SQUARE.**

Square roots, square miles, square blocks, square buildings and even square phrases like "the four corners of the Earth." Thousands of years of flat-earth thinking has tricked us into believing that reality is based on squares. But it just isn't so.

The most obvious example, of course, is the spherical planet that we inhabit. Plus there's a lot of other evidence that shows that nature puts things together with triangles and 60 degree angles, not squares and 90 degree angles.

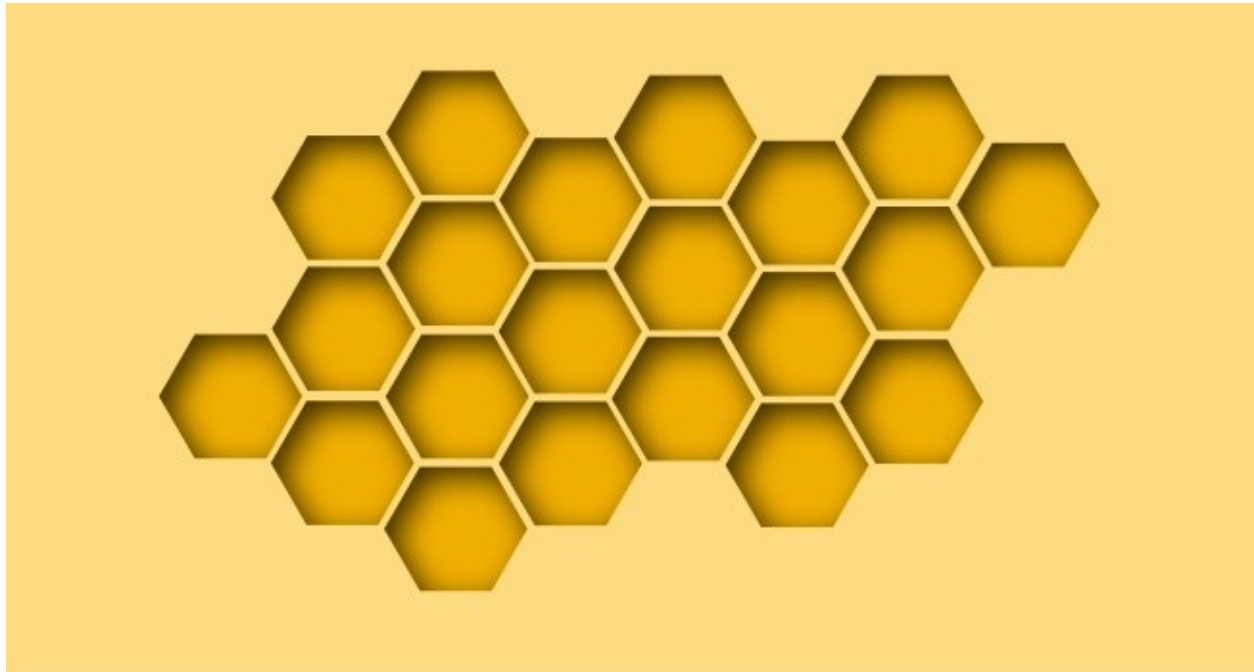
In 1885, an organic chemist named Van't Hoff determined that chemical bonding was based on the tetrahedron. The tetrahedron is nature's simplest, strongest structure and has just four triangular faces.



Then in 1932, Linus Pauling, using x-ray diffraction to probe the atomic structure of metals, found that metals were also based on tetrahedrons.

More recently, there's the discovery of the DNA Helix by Watson and Krick. This model, too, nature's basic life structure, is based on the triangular tetrahedron, not squares or cubes.

In fact, cubes themselves aren't real structures. If you make a cube with struts and flexible connectors, it won't even stand up. However, if you add diagonal struts to each of the cube faces, it not only stands; it becomes very strong. Look closely and you'll see that those diagonal braces create a red tetrahedron inside the cube above.



### THE HONEYBEE'S REAL JOB—AND YOURS

At first glance, it may seem that the honeybee's most important job is collecting nectar from plants and converting it to honey. But in Nature's scheme, the honeybee has a far more important role.

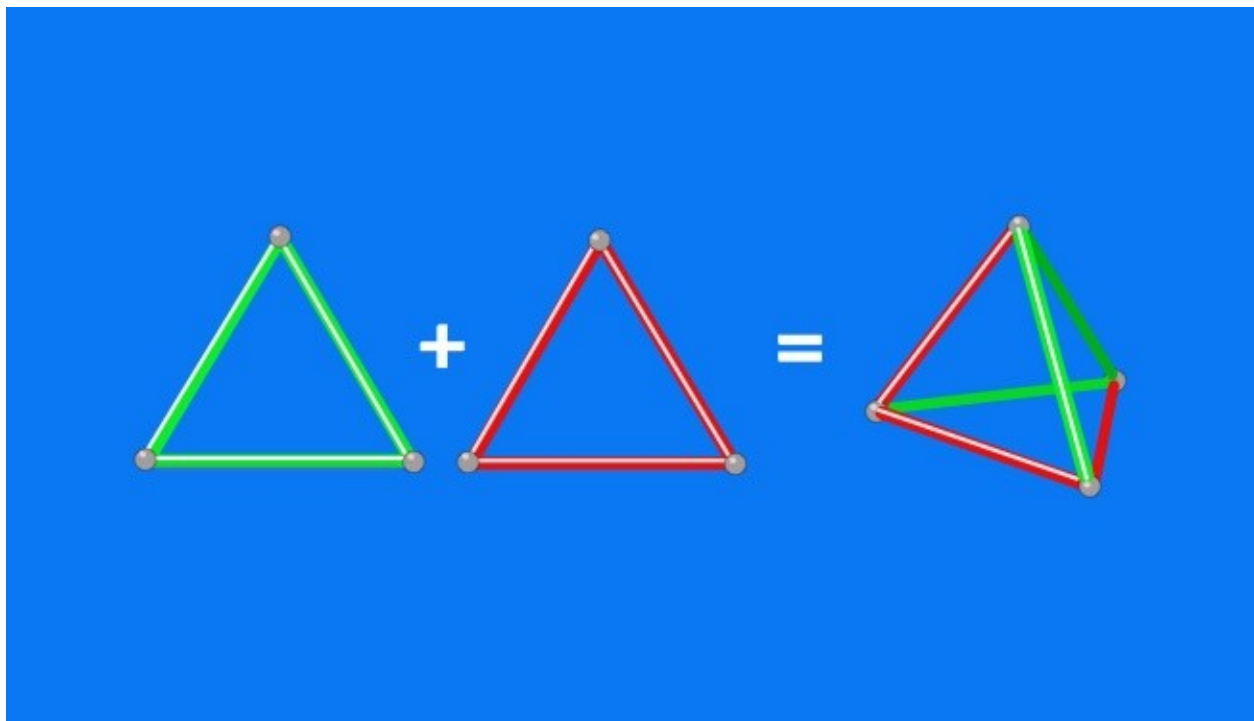
In its life-supporting search for nectar, the honeybee accidentally picks up male pollen from plants, then deposits it (again accidentally) on the female organs of other plants. In doing this, the honeybee plays a vital role in the whole life support cycle of Earth, not merely in life support of its own hive.

Just as the built-in drive for honey causes the honeybee to aid Earth's life support, our built-in drives for survival (money, warring, competition) has caused humans to accomplish many of the right life-support tasks.

Union organizers seeking higher wages and shorter hours, and manufacturers seeking higher profits, have spread purchasing power, making possible investment in equipment to produce better and better mass products and services.

Weapons producers, intent to earn money developing more effective ways to kill, have developed technologies allowing more people than ever before in history to live at higher and higher standards of living.

The scientific principal behind this indirect success is called precession. Using mind-discovered principles like this for universal life support is humanity's unique function on Earth. Other creatures, like the honeybee, have life-supporting drives. But only humans have a generalized-principle-discovering mind that increases life support.



ONE PLUS ONE EQUALS FOUR.

One of the most profound generalized principles yet discovered is synergy. Stated simply, synergy means that the behaviors of whole systems can't be understood by just knowing the behavior of each individual part.

For instance, hydrogen and oxygen are two highly flammable gases. But when they're combined, they form a liquid that extinguishes fire—H<sub>2</sub>O (water).

Another simple example of synergy can be shown with triangular models. In this case, you can use six toothpicks to make two triangles. But, if you combine those two triangles (1 + 1) to make one tetrahedron (see illustration), you now have a total of four triangles (1 + 1 = 4).

Unless you knew about the behavior of the system called tetrahedron, there's no way you would believe that one plus one could ever equal four. But it can, just as the tensile strength of chrome-nickel steel (350,000 p.s.i.) is more than the combined tensile strengths (260,000 p.s.i.) of all the metals which make it up.

That's synergy.



YOU'RE NOT WHAT YOU EAT.

This is not an argument for eating unhealthy food. Obviously, a nutritious diet is an important part of good health.

However, the things that make up your diet, good or bad, are not you, just as a tree is more than sunlight and water. What you (and the tree) really are is an abstract pattern integrity.

Think of a stone dropped into a pool of water. As the stone pushes aside the water molecules, a pattern integrity of waves develops, moving outwardly from the dropping stone. Those waves, though, are not the water.

If the same stone were dropped into pools of milk or gasoline, the same wave pattern would develop.

Just as the water, milk or gasoline are not the wave, the food you eat is not you. It's only the metabolic flow, starting with the Sun, that keeps your pattern integrity going.

Even the chemical elements that make up your body are not you. When a human dies, all the same chemical elements and sense organs of the living person are there in the corpse. Yet there is no life.

Neither your body nor the food that maintains your body are really the awareness called you.

## YOUR LIFELESS BODY

For centuries, people believed that there was an uncrossable physical gulf between living and non-living things—that hard, cold steel and granite are utterly different from soft, warm puppies and people. And this mistaken belief continues to this day, even though scientists have found that what we call living things consist of the same inanimate crystals that make up rocks and steel.

The mistake began—and continues—with the assumption that life is a physical thing. It's not. The physical thing, whether virus, cell, puppy or human body, is the vehicle which life uses, just as a telephone is an instrument used to transmit ideas. But the telephone is not the ideas. And the physical body is not the life.

Ironically, the non-physical quality of life becomes most apparent with death. When a person dies, all the physical elements of the living body are still there, the organs are there, yet there is no life.

Whatever life is, it's not physical. Physical things are lifeless.



### AN AMAZING SPACESHIP

Some day it may be possible to create a spaceship that could support its crew almost indefinitely and travel through Universe at a speed in excess of 700,000 miles per hour.

On board the ship would be everything needed to support life for millions, even billions of years. Water would be purified for drinking by an evaporation process utilizing radiation from a star. Food, too, would be constantly produced using the same radiation. And a breathable air supply would be maintained through a remarkable interchange involving carbon dioxide-breathing plants and oxygen-breathing animals.

Of course, there really is no need to build a spaceship like this. We already have one. And we call it Earth.

### EARTH'S SCREWY TRIP THROUGH SPACE

Though books and illustrations of our solar system show Earth traveling in a nice flat orbit around the sun, our movement through space is not really flat. It's a spiral.

This spiral results from the Sun's rotation around the center of the galaxy at a speed of 700,000 miles per hour. It's this flight, along with the Sun, that stretches our own yearly orbit from a flat circular path into a spiral, just as a round spring coil can be stretched out.

Our spiral trip through space is an example that there are no flat planes or linear paths in physical Universe—only spirals and curves, some so large that they appear flat or straight (the surface of the Earth, for example).

Today, however, nearly all model studies, schematic probability studies, and even critical path studies are carried out in linear formats.

Unfortunately, comprehensive problems are never linear. Like Universe, they're omnidirectional. So studies that deal with problems as linear omit vital information and relationships. That's one reason why world society has so many serious problems.



THE SUN WON'T COME UP TOMORROW.

"Oh, just look at that beautiful sunset!" Or, "Let's meet here tomorrow at sunup." Or, "Tomorrow, sunrise will occur at 6:39 a.m."

Though they all sound innocent enough, there's a serious error in each one of these statements, an error we've had 400 years to correct.

It was 400 years ago that Copernicus and Galileo gave us scientific proof that it's Earth that revolves around the Sun—that the Sun doesn't set in the evening nor rise in the morning. Earth, spinning on its axis, rotates us out of sight of the Sun in the evening and rotates us within sight of the Sun in the morning.

Yet here we are, more than 400 years later, still saying, "sunrise" and "sunset" just as if Earth were flat and the Sun were going up and down in space.

There are many other terms we could use which more accurately express what is really happening—"first light" or "sun morn" for sunrise, "last light" or "sun eve" for sunset.

Think about it the next time you watch a beautiful sun eve.



POOF, THERE GOES ANTARCTICA!

Imagine if an area of Earth larger than Europe suddenly disappeared.

Well, according to the world map shown here, the continent of Antarctica has done just that. In addition, Greenland (840,000 square miles) looks twice as large as the United States (3,600,000 square miles), and Russia is split in half so that places only a few miles apart appear 25,000 miles from each other.

Of course, this isn't the way Earth really is. Yet this map, known as a Mercator projection, is the map used in schools almost everywhere.

Here's how it got so distorted. To make a Mercator projection, a cylinder of paper is placed around a lighted globe, and the shadow images from the globe are traced on the paper cylinder. Since the Earth is a sphere, not a cylinder, there's greater and greater distortion as you move away from the Equator.

Fortunately, there is a world map that does show the entire Earth without any distortion—The Dymaxion Air Ocean Map below. It's made by projecting the image from a globe onto an icosahedron (a spherical object with 20 triangular faces), then unfolding the three-dimensional



icosahedron to make a two-dimensional map.



Beside showing all land masses in their true proportions, the Dymaxion projection shows the entire continent of Antarctica and the important air-route relationships of the Northern Hemisphere continents, the areas where you find 90 percent of all Earth's people.

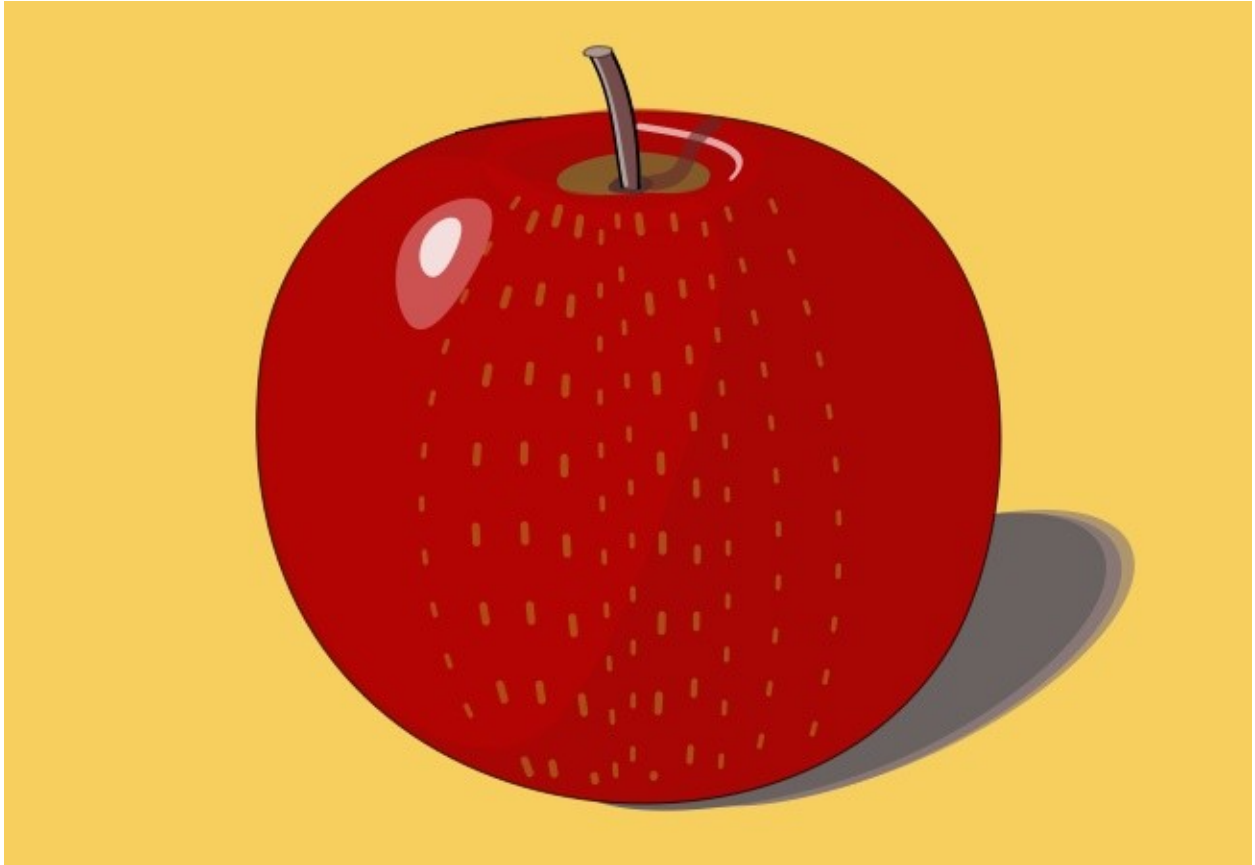
## OUR WISPY OCEAN

Compared with our own human height, Earth's ocean\* seems incredibly deep. But measured on a cosmic scale, our ocean's waters are a mere wisp.

For example, the ocean, averaging a mile in depth, is only 1/8,000th of Earth's diameter.

To fully appreciate this size/depth relationship, think of a stainless steel sphere one foot in diameter (about the size of a basketball). If you place your mouth close to the steel sphere and exhale, the moisture left on the sphere from your breath would about equal the ocean's depth on Earth.

\*Ocean (singular) is used because Earth actually has only one ocean. But naming different areas of it Atlantic, Pacific, Indian, etc., has concealed this important fact about our planet.



#### THE OTHER ADAM AND EVE STORY

We've all heard of the ancient priests of Egypt and Babylon—the wise men, the wizards. But few history books record the powerful role that they played behind the thrones of the ancient kings.

This power sprang from the priests' knowledge of mathematics, astronomy and navigation. Using their navigation skills, the priests would sail off to unknown lands, returning with exotic plants, animals, artifacts and other mysterious things.

Many priests, in fact, learned that Earth is round, either from direct experience or from knowledge passed on by their priest ancestors. The Adam and Eve story we know was probably the story of one of those ancient priest/navigators.

In the original story, Eve was not a woman, but a vessel\* or ship. And, instead of being a raft, reed boat, or dugout, the ship Eve was built with ribs, like Adam's chest. Plus she had another revolutionary feature: a movable sail.

With that movable sail, Adam was able to defy the ancient sea god, Naga, and sail into the wind. In ancient times, people believed that trying to sail into the prevailing easterly winds was going against the will of God.

On his voyages with Eve, Adam also discovered something else that contradicted ancient beliefs: Earth is round, like an apple.

\*The word "vessel," when translated from an earlier language into Sanskrit, was changed to "woman." To this day, ships are referred to as female.



## HOW CATTLE GAVE BIRTH TO INFLATION

There was a time in human history when nomadic tribes roamed anywhere with their herds of animals. All lands were open and free. Gradually, armed warlords claimed the best pastures, then forced the herders to buy or rent parcels of this land for grazing.

The payment demanded by the warlords (later landlords) was greater than the herders' wealth in skins and livestock, so the landlords loaned the herders the purchase price of the land. As down-payment, the landlords took possession of some of the herders' cattle.

Then, each year, the landlords took as payment toward the purchase price some of the cattle from the collateral (down-payment) herd, plus "interest" in the form of the young cattle born that season.\*

About 4,000 years ago when sea trade developed, cattle became impractical as payment, so coin money was invented. The coins had portraits of landlords (sovereigns) on them.

Though coins can't reproduce themselves and increase wealth as cattle and other livestock can, the practice of collecting interest was continued. But, because there's no biological wealth increase to support this interest taking, interest deflates money's value and inflates prices.

Today, with hundreds of billions of dollars in interest paid yearly on the United States national debt alone, there's a tremendous amount of interest-generated pressure that inflates prices.

\*The Latin word for cattle is capital.

### WHY 13 IS "UNLUCKY."

People often wonder, "Why is the number 13 considered bad luck, especially on Friday the thirteenth? Why is there no 13th floor on most elevator controls? And why are 7 and 11 also considered unlucky numbers, including 'crapping out' numbers in dice?"

It's all about numbers themselves and, in this case, prime numbers.

Prime numbers are those that can only be divided by themselves and by 1. They include 1, 2, 3, 5, 7, 11, 13, 17 and so on. So why are only three prime numbers considered unlucky?

Like many things, the answer to that lies in history, in this case, the ancient history of Mesopotamia.

In those days, the priest-mathematicians (grand viziers, wizards) wielded incredible power because they held the mathematical secrets required for navigation and trade, as well as for accounting, calendar making and many things that we now take for granted. Back then, for example, ordinary citizens, and often even the king, didn't know how to add, subtract, multiply or do other calculations.

One way that the priests kept the population ignorant was by telling elaborate or misleading stories to hide the true facts and knowledge. One of those stories was the myth of Scheherazade and her Thousand and One Nights.

It was no accident that the story involved 1,001 nights, not 1,000, not 1,002. It was because 1,001 is a mirror-image number that when multiplied by itself produces other mirror-image numbers. For instance, 1,001 to the second power produces 1,002,001 and to the third power produces 1,003,003,001. (Note that a number representing each power ends up in each new total number.)

The real significance of using 1,001 is that it allows a form of mathematical shorthand. The mirror-image numbers also reflect the binary system of our present-day computers. To prevent

anyone else from discovering the highly significant number 1,001, the priests warned that bad luck would come to anyone who used the numbers 7, 11 or 13.

You see, if you multiply 7 times 11 times 13, the result is 1,001.



## THE NOTHING IDEA THAT CHANGED THE WORLD

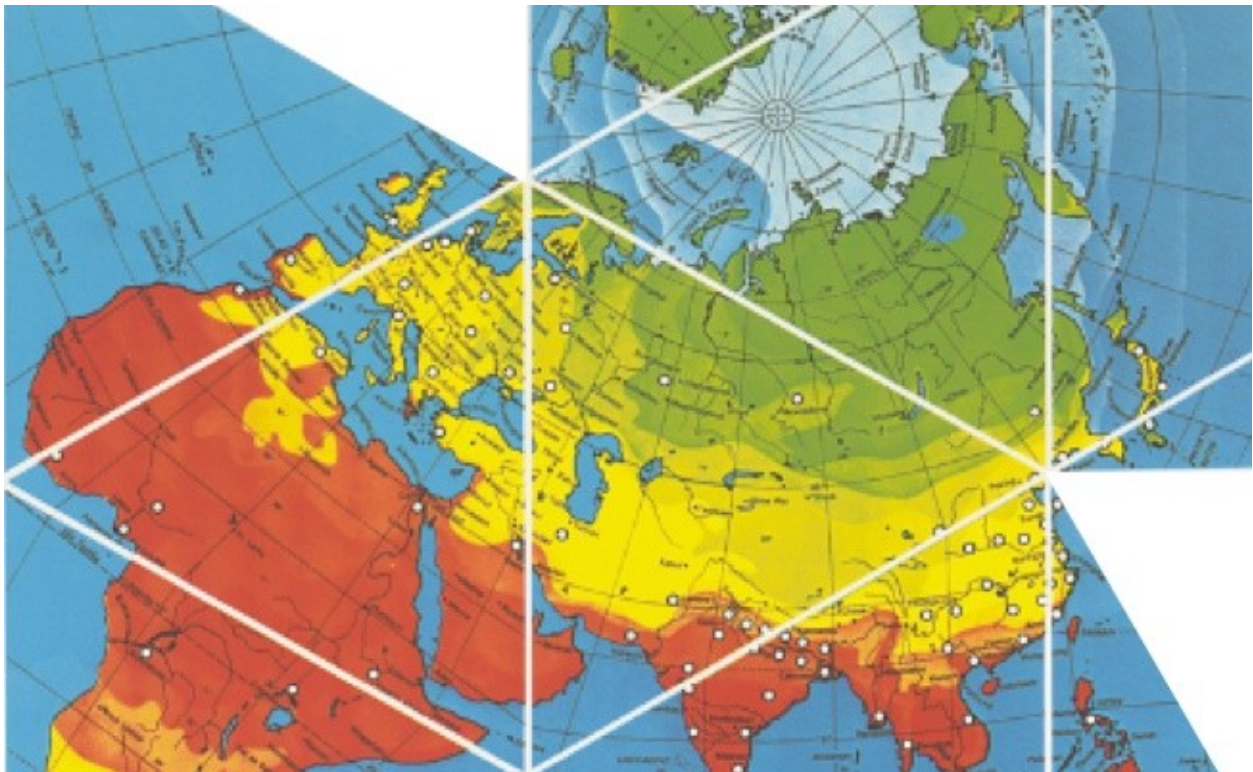
Though we take it very much for granted today, the zero is one of humanity's most profound and useful discoveries. Without it, modern accounting, engineering, astronomy, navigation and many other fields based on math couldn't exist.

And yet, the zero itself didn't exist during most of humanity's time on Earth. In ancient times, when most people were farmers and herders, simple counting and notating with scratches were enough. But a few thousand years ago, mathematicians in the orient developed a symbol to represent the empty column of the abacus. It was a circle with a dot in its center and was originally called cipher.

When Europeans first began using Arabic instead of Roman Numerals around 700 A.D., they thought the cipher or zero symbol was only a decorative form of punctuation.

Then, around 1200 A.D., European scholars translated a book written by a Persian named al-Khwārizmī. This book explained how the zero was meant to be used and how it enabled complex calculations impossible with Roman Numerals.

Use of the zero spread, and its effect on calculation was so profound that it helped to shatter the Dark Ages, making possible the discoveries of Copernicus, Brahes, Galileo, Newton, Kepler, and da Vinci. Today the complex calculations required to put humans into space would not be possible without zero.



### A COLD FACT THAT STOPPED HITLER AND NAPOLEON

We all take it for granted that the further north you go the colder it gets. Yet, in Eurasia, where 76 percent of all of humans live, the reality is: go east, go cold.

You can see this graphically illustrated on the map shown here.

Colors on this map represent mean low temperatures. Deep orange is warm (86°F). Blue is cold, very cold (-58°F). And shades of orange, yellow and green fall somewhere in between, with oranges and yellows being warm and the greens being cold.

If you look at the Atlantic coast of France, it's tinged with light orange, which means it has a mean low annual temperature of 59 F. And if you stay in exactly the same latitude, but go east all across Europe and Asia to the Pacific coast, it's colored green, which means it has a mean annual temperature of -22°F.

Ignorance of this go-east-go-cold characteristic of Eurasia is what defeated both Hitler and Napoleon when they invaded Russia. Among other things, Hitler's tanks and trucks were stalled by simply having the wrong lubricating greases for Russia's frigid climate.



SEEING IS NOT BELIEVING.

We can't see microwaves, though we know they can bake a potato or heat a casserole in minutes.

We can't see stars move, though they're traveling thousands of times faster than our fastest rockets. We can't see wireless radio or television signals, though they bring us sports shows and the six o'clock news. And we can't see Wi-Fi or cell phone signals, radar waves, atoms, x-rays, or ultra-violet light.



The fact is, we see only a millionth of our total physical reality. And because we see so little of what's going on with our own unaided eyes, we discover most of our world's problems by surprise—usually when it's too late to effectively deal with them.

Pollution, the so-called energy crises, inflation and the threat of Earth-destroying nuclear war are all examples.

The key to early identification of problems like these is to use tools that can increase our very limited senses—tools that make visible the invisible by slowing down events too fast to be understood and by speeding up events too slow to be understood.

Most of those tools, including computers, game theory simulation, trend charting, slow-motion and time-lapse photography, already exist.



#### OVERSPECIALIZATION KILLS.

Specialization is a strategy originally invented by kings and captains of industry in order to protect their secrets of power and wealth. Subordinates were organized into separate ministries or

departments to keep them ignorant of the kingdom's (company's) total capabilities. Only the top man had access to all of the information.

Today, everyone clings to specialization in an attempt to assure his own economic security. "If I'm the expert on widget welding, anyone who wants a widget welded will have to come to me."

But, at an historic meeting for the Advancement of Science, two studies were presented which showed that overspecialization as an individual or collective strategy is obsolete.

One of those studies dealt with the extinction of animal species; the other dealt with the extinction of human tribes. Though independently conducted, both studies came to the same conclusion about the cause of extinction: It resulted from overspecialization.

The reason is simple. Evolution involves constant change, and when living species become so specialized that they can't adapt to large evolutionary events, they die out.

Threat of a world annihilating nuclear war is a chilling example of overspecialization. Through their super specialization, mathematical physicists learned how to control the fission and fusion of the atom, but not how to control the military, political and commercial exploitation of their life-threatening discoveries.



## WIND SUCKS. IT DOESN'T BLOW.

A TV weatherman may report, "The wind is blowing from the west at 14 miles per hour." Or your Uncle Harry may declare, "Boy, it's really blowing out there." But in reality, wind doesn't blow. It sucks.

When you try to blow air, it behaves like water as you try to push it toward a bathtub drain. It curls back on itself. That's the reason for smoke rings and the characteristic mushroom clouds that you see after an atomic bomb blast.

Air has to be pulled (sucked) to be moved effectively. For instance, an exhaust fan can easily suck air in through open windows—and all through your house, even around corners. Yet, if turned around to blow, the same fan can only move air a short distance.

Wind works the same way. When someone says, "The wind is blowing from the west," what's really happening is that low-pressure air to the east is sucking high-pressure air from the west. The wind you feel is the air being sucked past you.

## GREAT STRENGTH TAKES PULL, NOT PUSH.

It's no accident that our elevators, cranes and great bridges use cables to support the tremendous loads they carry. The tensile (pull) strength of steel is far greater than its compressive strength.

And, even more important, steel cables or guy wires used as tension members have practically no length limits. But even the strongest steel columns (compression members) are limited to a length 33 times their diameter. Beyond that length, the columns have a tendency to buckle.

For example, if the elevators of the Empire State Building were pushed up by steel rods, those rods would have to be as wide as the building itself to resist buckling. Yet pulled from above, cables of an inch or less in diameter do the job.

Despite this strength-to-diameter advantage of steel in tension, most of our homes, offices and factories are built primarily with compression members. The result is thicker walls, bigger beams and, in general, far heavier structures than could be made with tension structures. And, naturally, the more material that goes into a structure, the more it costs.

## MORE FROM LESS

One of the most incredible trends now taking place is the ability of our technology to get greater and greater performance from lesser and lesser amounts of physical material—to do more with less.

When the first copper telephone wires were used, they carried just one message per wire. With further developments, this was increased to 2, 4, 16, 250, then thousands of messages per wire.

Now, satellites carry thousands of messages—with no wires at all. Tiny computer chips perform the same calculations once performed by room-sized tangles of vacuum tubes and wires. And a jet airplane weighing a few dozen tons can carry more people across the Atlantic in one year than a ship weighing tens of thousands of tons.

The examples go on and on. But the real importance of this more-with-lessing is that it dramatizes our increasing ability to feed, clothe, educate and care for all of Earth's people.

As recently as the year 1900, only one percent of all Earth's people were able to avoid the starvation or unhealthy living conditions that lead to early death. Today, that figure is about 60 percent. And this was achieved using technology with an overall efficiency of only four percent.

By consciously accelerating the more-with-less trend, this efficiency could easily be doubled. The result: enough food, clothing and shelter for everyone on Earth.

## THE POLLUTION SOLUTION

Pollution is really valuable chemicals in the wrong place. And its prime cause is overspecialized (narrow-minded) thinking.

"We can't afford to stop the pollution from our smokestacks," says a corporate management, "because then we won't be able to compete with companies outside the area who don't have to stop polluting. If local government forces us to stop polluting, we'll move."

The politicians say, "Don't move."

So pollution keeps being pumped into our sky and water, where it costs thousands of times more to collect than right at the smokestacks or nozzles.

In fact, the chemicals that are considered pollutants in one area are always needed somewhere else. For instance, all the sulphur coming out of industry's smokestacks every year exactly equals the sulphur mined every year to keep industry going.

So recirculation or recycling is the real pollution solution. Just as in nature, nothing is wasted. This year's fallen leaves become next year's flowers. Waste carbon dioxide from animals is used by plants and waste oxygen from plants is used by animals.



## HEAPS OF WEALTH

When we look at scrap, most of us see industrial eyesores—rusting reminders of our long-dead refrigerators, toasters and automobiles. What we don't see are two very profound industrial principles about scrap.

The first is that Earth's supplies of iron, copper, tin and other mineral elements aren't all buried in mines. Vast quantities of those great resources already exist above ground in buildings, machines, beer cans, and, of course, scrap heaps.

For instance, the United States has no tin mines, but in aircraft and rocket production soft tools, it has more tin reserves than Bolivia has in its vast tin mines. And 86 percent of all copper ever mined is now in constant recirculation.

This recirculation is made possible by a simple physical fact: Chemical elements never wear out or become useless, no matter how many times they're recycled.

Now here's the second profound principle relating to scrap: It recirculates approximately every 22 years. And every time that scrap recirculates, it comes back to us as more and more efficient machines, factories and products—airplane engines with more horsepower per pound, generators that produce more electricity per unit of fuel, and automobiles that get more miles per gallon.

On top of all this, the reuse of minerals from scrap is far more efficient than mining, processing and refining new minerals from ore.



#### \$1,000,000-A-GALLON GASOLINE

No, OPEC and the oil companies didn't just vote themselves a whopping price increase. This is the real cost of producing a gallon of gasoline, not according to OPEC, not according to the oil companies, but according to Nature.

The fact that we can sink a pipe into the ground and pump out the oil fooled us into thinking that it's free. But now that oil is getting more and more scarce, we're beginning to realize that it's far from free. Still, this is just part of the truth.

Many years ago, scientists calculated how much it actually would cost to produce from scratch the seemingly free oil we take out of the earth. These calculations included the cost to reproduce the organic chemicals, and the immense amounts of heat and pressure that changed the organic material into petroleum. The resulting figure was \$1,000,000 a gallon.

## WASTING THE ENERGY OF 200 MILLION HORSES

A major part of wasteful energy consumption is just plain inefficiency. Out of every 100 barrels of oil consumed by the world, 80 barrels are completely wasted. That's because our machines and processes using oil have an overall efficiency of only 20 percent.

Our automobiles are even less efficient. Their reciprocating engines waste 85 percent of the energy in every gallon of gas. On top of that, those engines keep running (using energy) when cars are stopped at traffic lights. So, with 2 million cars halted at traffic lights at all times, there are the equivalent of 200 million horses jumping up and down going nowhere.

There are more efficient machines and processes which could easily help stem the world's overall energy waste. Turbines are 30% efficient (twice as efficient as reciprocating engines). Coal-burning generators are 40% efficient. Jet engines are 60% efficient. Fuel cells are 80 percent efficient. And large electric motors are 90% efficient.



THROWAWAY SUPERTANKERS



A simple law of geometry is behind many oil spills. That law states that when a system (three-dimensional object) is doubled in length, its surface area increases by four and its volume increases by eight.

In terms of oil tankers, this law means that if you double the length of a ship, its surface area (hull) increases four times and its cargo volume or capacity increases eight times.

Or if you look at it in relation to cost, every time you double the length of a ship, you cut the delivery cost per barrel in half.

During the 1970s oil tankers didn't just double in size; their size increased tenfold. As a result, transoceanic oil delivery costs became so negligible that some shipowners could nearly afford to give their ships away after just one voyage. Therefore, owners were not too concerned if a ship sank after just a few voyages.



### ENERGY-GOBLING CITIES

Seen from a distance, our skyscraper cities are a mass of spines sticking into the air. In terms of energy efficiency, this is the worst possible design.

Spines are like the fins of an air-cooled engine. The fins speed up heat loss from the engine by increasing its surface area. And with our spine-shaped cities, the surface area compared to the space inside the buildings is even greater than in air-cooled engines.

The importance of surface/size relationships relative to energy efficiency is easy to see in the melting rate of icebergs versus snowflakes. Icebergs, because of their large mass, melt very slowly. But something as tiny as a snowflake melts in a flash.

This means that enclosing existing cities in single structures and designing single-structure future cities would result in a tremendous reduction in heat loss (or gain) through exterior walls.

Further reductions in city energy losses could be made by using domes as the enclosing structures for city space. A dome covering the same area as a cube-shaped structure has one-third less surface area.

If a two-mile diameter dome were used to enclose New York's Midtown Manhattan from the East River to the Hudson River and from Twenty-second to Sixty-fourth Street, it would have only one-fiftieth the surface area of present city buildings. That means heating and cooling costs would be reduced 90 percent or more.



## MORE ENERGY OVERNIGHT

There's an interesting fact about Earth that seldom appears on maps or in textbooks: Most people live north of the Equator. In fact, that's where 90 percent of all Earth's people live.

There are a few simple reasons for this vast north-south population difference.

First, there's land distribution. The land areas north of the Equator add up to 77 percent of all Earth's land.

That leaves only 23 percent for the southern hemisphere. And those small Southern Hemisphere land areas are separated by vast areas of ocean.

With 90 percent of Earth's humanity concentrated in the Northern Hemisphere, it would be relatively easy to create a worldwide electricity distribution network. Excess nighttime generating capacity from one side of the Earth could then help satisfy peak daytime electrical needs of the other side. This means we could literally double the available electrical supply of Earth overnight, without adding any new generating plants.



## NO ENERGY SHORTAGE

Based on the work of Einstein and Planck, physicists have developed the "law of the conservation of energy." Simply stated, this law says that energy can neither be created nor destroyed. Instead, it merely passes from one system to another.

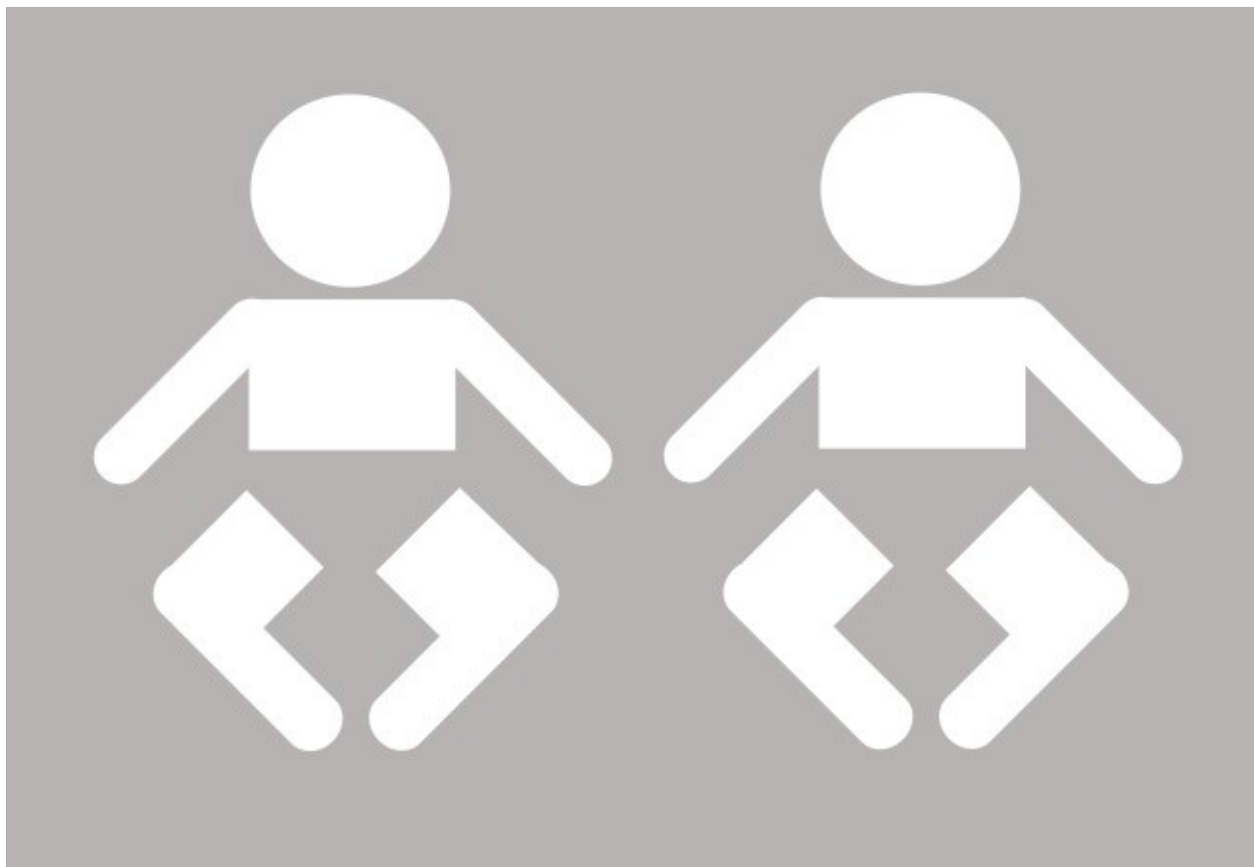
And since Universe is all energy, either as matter or radiation, we actually have a whole Universe of energy which can never be used up.

Earth itself is a vast receiving station of this energy. The amount of energy that Earth receives in just one minute (168 quintillion horsepower or 125 quintillion kilowatts) is enough to satisfy all the world's energy needs for an entire year.

In addition, there's the mechanical energy from the Moon's gravitational pull. Earth's ocean stores that energy in its tidal changes. At the Bay of Fundy, where there are twice-daily tidal changes of 70 feet, we could harvest more pounds of energy than all humanity could ever need.

What we mistakingly call the energy "shortage," "crisis" or "crunch" is merely the short-term exploitation of fossil fuels because they're easier and more profitable to exploit than the low-cost alternatives.

"A global energy Strategy" developed back in the 1970s by a World Game® research group under Medard Gabel showed that, within 10 years, all fossil fuels could be phased out and alternatives like tidal, alcohol, wind, solar, and methane energy could be phased in. And there'd be enough energy for everyone on earth.



#### **THE GREAT POPULATION MYTH**

In 1798 Thomas Malthus wrote: *An Essay on the Principle of Population*, indicating that people were reproducing themselves faster than their ability to produce food and other life-sustaining items. Later, while Professor of Economics at East India College in England, Malthus received data from The East India Company's vast world network of trading centers which seemed to validate his dismal prediction.

Though it seemed accurate at the time, there was one essential piece of information omitted from the Malthus population equation: the increasing productivity of The Industrial Revolution.

For instance, Malthus had no way of knowing that foods which often rotted would one day be canned, refrigerated or frozen to be shipped all over the world, and that machines would be invented that could do the physical work of hundreds of men, and that electric lighting would allow production to go on 24 hours a day.

And, perhaps even more important, he had no knowledge of the impact that these advances would have on human reproduction.

Though there are no census records earlier than 1790, accurate population records are available from family Bibles and diaries of that time. These records indicate that during the American Colonial Period the average number of children per family was 13 and that average life expectancy was 27 years.

But, as industrial tools and things like water purification, electric lighting, telephone and telegraph came in, the birth rate went down and life expectancy went up. Today, in the U.S., the birth rate is less than two children per family and the life expectancy averages 75 years.

This trend is not exclusive to the United States. It happens in all countries that achieve industrialization. So, as more and more countries of the world become industrialized, total world population will stabilize, too.



### THE INVISIBLE REVOLUTION

A vast global revolution has been taking place, virtually unnoticed by the world's people. This revolution doesn't involve any military coup d'etats, political bloodbaths or government overthrows. In fact, instead of pulling the top down, this revolution involves pulling the bottom up.

Ironically, this bloodless revolution was made possible by the race to create ever more efficient weapons of war. By developing greater and greater killing power per each unit of physical resources, the producers of military hardware have incidentally learned how to develop greater and greater living power for each person on earth.

Electric lights, central heat, radios, refrigerators and air conditioners were all originally designed and used only as battleship equipment. Airplanes, made more and more efficient in order to deliver the greatest destructive power, now deliver people and products almost anywhere on Earth in hours. Missiles, originally designed to carry atomic warheads, now put communications satellites into orbit. And computers and the Internet, first designed to control the

military's complicated weapons systems, today allow us to shop, ship or stay in contact with almost anyone, almost anywhere.

In short, more than half the people on Earth now live better than the wealthiest kings of previous times. And even more important, the invisible revolution has made obsolete the philosophy of scarcity which breeds war.



#### REAL WEALTH

Though they're still valuable as technological resources, diamonds, gold and silver have been made obsolete as measures of wealth by The Industrial Revolution.

In fact, wealth has increased so much during the past 150 years that more than half of Earth's people now live better than any king or emperor of any previous age. Still, that wealth doesn't come from having vast amounts of diamonds, gold, silver or cash.

If wealth were gold, for example, then all the world's factories, homes, businesses, jet aircraft, ships, railroads, etc. would be worth just \$500 billion, because that's all the minted gold there is. Yet in developing the airplane alone, the nations of the world spent \$2.5 trillion (five times more than all the minted gold).



Where did the additional wealth come from?

Not from banks. Not from diamond or gold mines. It came from the world's physical energy and our technological know-how. And since energy can't be destroyed and know-how can only increase, wealth is ever-increasing.

Money, too, is obsolete as a measure of wealth. The German people proved that after World War I. In financial terms, they were completely bankrupt. However, they had blast furnaces, iron ore and coal, plus the expertise to make steel. They put those resources to work, and, within a few years, the German people were prosperous again.

Today, by concentrating our know-how on real wealth production, everyone on Earth could have a standard of living higher than ever enjoyed before by anyone in history. And it could be done in just 10 years.

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### ABOUT PETE CHASAR

Pete Chasar, who grew up in New Jersey and for 28 years lived in Arizona, is now a writer and artist on the southern Oregon coast. While in Arizona, he became an avid hiker and advocate for preservation, especially preservation of Scottsdale's McDowell Mountains. He was a founding

member and original chair of the McDowell Sonoran Conservancy, as well as a member of Scottsdale's McDowell Mountains Task Force and two committees of Scottsdale's McDowell Sonoran Preserve Commission. In addition to his achievements as a preservationist, Chasar had a 35-year career in advertising and graphic design. While working in New York in 1970, he first started reading Buckminster Fuller. A few years later, after moving to Phoenix, he became a good friend of Mike Paterra, one of Fuller's former students. Over the years, the friends had many discussions about Fuller's ideas. Then in 1980, Paterra introduced Chasar to Fuller in Phoenix after they attended one of Bucky's marathon talks.

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## PETE'S OTHER BOOKS

Pete Chasar has also written *Desert Spring—Learning to Love and Preserve Wild Arizona*, a colorful first-hand account of one person's journey from a New Jersey-Manhattan commuter to a desert trekker and then advocate for one of Arizona's most successful land preservation programs.

The story is told using evocative narrative about hikes and other personal outdoor adventures, as well as descriptions of the hard-fought battles involved in the preservation of natural areas threatened by development. It's a natural history travel narrative, as well as a case history to enlighten and inspire individuals and groups struggling to preserve their precious natural areas.

Themes presented:

- Western landscapes can be magical places that transform an ordinary person into a dedicated advocate for preservation.
- Government policies—particularly federal subsidies for flood control, highways, and massive water projects—are fueling intense sprawling growth that is rapidly erasing the West's natural diversity.
- Though the economic, political and legal obstacles are formidable, preservation of unique natural areas is possible. But it takes organization, money, patience, and the ability to withstand some financial and emotional pain.

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