# Life: An Instruction Manual

The ancient covenant is in pieces. Man at last knows he is alone in the unfeeling immensity of the universe, out of which he emerged only by chance. His destiny is nowhere spelled out, nor is his duty.

- biologist, Jacques Monod, 1972

This life is only a test. Had this been a real life, you would have been given instructions on how to think and what to do.

- Anonymous, circa 1990

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# Introduction

As a natural part of growing up, we acquire a set of **beliefs** from our family, from acquaintances, from various media, and from the many institutions that have influenced us. In fact, we acquire more than beliefs, we acquire a **vocabulary** of concepts and a **repertoire** of techniques. These form the very content and ability of our minds and ourselves.

Developing minds are often full of contradictions and ambiguities. Teenagers may try to resolve some of the conflicts that become evident to them, but as we grow older there is a tendency to get used to conflicting ideas. Since our brains didn't come with a user's guide, we do the best we can.

There are two common strategies for dealing with conceptual conflict. One strategy is to accept a core of beliefs without much question, and then grow beyond it on the basis of what fits into it. Another strategy, perhaps the most common one, is to develop a variety of core systems. Often, these independent systems do not fit together very well, but we learn to live with them, keeping them separate in our minds and in our lives. There are many less common strategies. These range from the sudden, all encompassing epiphany of the "born again" to a slower, life long process of revision whose goal is to sort things out and acquire the most practical, useful, and coherent set of techniques and concepts that one can. This book is written for people using any approach, but who would like to **learn** to use this last approach.

Our experiences often teach us that life can be capricious, unfair, and chaotic. But, if we don't wish to be like a cork bobbing about in the waves, we have to believe that with effort and focus, we **can** get a **grip on ourselves**, and on **life**.

In this book, I have tried to produce a coherent point of view with a minimum of contradiction and ambiguity. Several choices have been made in the interests of smoother reading. "Standard English" is used as much as possible. Technical jargon has been avoided where possible, or explained where it seemed useful. Any word not clear within its context should be clear from its dictionary definition. If gender is not explicit within a context, the unmarked (masculine) forms refer to **both** females and males **alike**.

Every fragment of thought within this book was probably said first, and possibly said better, by someone else. Many ideas and sayings are commonly associated with a particular person, others may have originated in antiquity or have been quoted so often that they are truly in the public domain. In the former case, the author is named. In the latter case, the concept may involve either ancient knowledge or a much-discussed, contemporary topic. In either case, no one else should be "blamed" for the way the topic is treated here. When more than a paragraph of any person's work is **copied** and disseminated, copyright laws pertain. But the transmission of **ideas** is a basic freedom. This freedom cannot be exercised without using words and fragments contained in other copyrighted works.

## The Book's Organization

This book is organized into a set of chapters with a table of contents so you can see its overall structure. It has an index to help you access unfamiliar words and important topics. The index also refers by keyword to a list of additional reading. This list allows you to explore further many of the ideas and topics. Every word in *italics* is a keyword that appears in the index.

This book is organized in three parts: Past, present, and future. Part I explains our heritage and what others have made available to each of us. Part II is about our personal selves and what life is about on a day-by-day basis. Part III looks ahead to our individual and collective futures. The book concludes with a small collection of epigrams to stimulate further thought. The purpose of this book is to help you get your mind organized and oriented, so that life will be a little less of a mystery and a little more of a **welcome journey**.

Chapter 1 is about beginnings. It reviews the principles of *evolution* and the origin of our human species. It includes an introduction to *logic* and some thought exercises that will help pave the way for later chapters.

Chapter 2 continues the development of a logical outlook on life. It explains what *science* is, scientific methodology, and why a "scientific approach" is the best way to understand the world around us. It introduces a few of the topics and debates of modern science and philosophy.

Chapter 3 is all about ourselves and what we have in common with each other. It explains some of our individual *strengths* and *weaknesses*, and gives some advice on the care and feeding of the normal human mind and body. It explores a little further the relationship between our minds, our bodies, and ourselves.

Chapter 4 is about our interactions with each other. It gives some strategies for getting along with people in different circumstances, and suggests some ways that *men* and *women* might get along better in the modern *workplace*. The subject of social and personal *power* is also introduced.

Chapter 5 relates to the process of *creation*. Part of this is the cycle of birth, growing up, and becoming a parent. Some aspects of the curricula for schools, apprenticeships, and self development will be suggested. Procreation is just the inner cycle; the chapter concludes with some other aspects of *creativity* and the process of creation.

Chapter 6 discusses *religion* and *politics*. It explores our age old fascination with *mysticism*, folk *tales*, and the *occult* and how these tie into deeply rooted needs, affect our social reality, and stem from our *ancient covenant*. Modern government is analyzed as to what it has become, what it should be, and why. For those who do become involved, some ways to make a difference are presented.

Chapter 7 begins with some "prognostications" for the next thousand years or so. It outlines a strategy for meeting the near term future. And then it concludes with some suggestions for a new covenant that we can help evolve to replace the ancient one that is now in pieces.

Chapter 8 is a collection of "tidbits" to think about. It's easy to find, and it's intended to be sampled whenever you like!

## The Book's Context

This book was written in the last decade of the previous century, when I was 50. This is an edited version, but its original ideas have been left intact to illustrate how much has changed over the past twenty-two years.

An *information*, communication, and computation explosion is facing humanity. Never before has information been so available. Never before has the mind had such powerful tools to amplify its abilities. And yet, **never** has it been so difficult to figure out what to do next!

People's minds are overloaded. We need to be able to focus and to cope. Groups can do certain kinds of intellectual work better than individuals. It is no longer possible for individuals to understand many significant things that we as a species do understand. All of these developments are recent. We can't evolve fast enough to keep up. So, what **can** we do? Are we doomed?

Every living thing was born with an instruction manual coded into its genes. But, what sets us apart from the other animals is how far our capabilities go beyond our genetic instructions. We have

extended our heritage into a vast literature and the skills of living experts. Buried in all of this, **is** our instruction manual.

## Ten Instructions to Start With

The following ten rules tell how to live both effectively and well. They draw **very** heavily on the poem, **If**, by Rudyard Kipling. As an exercise for the student, seek out a copy of Kipling's poem and discover its beauty for yourself. And, think about these instructions from time to time.

1. Keep your head, even while those about you are losing theirs and blaming it on you.
2. Don't look too good nor talk too wise; and trust yourself, even if others doubt you, but make allowance for their doubting too.
3. Be truthful, no matter what lies others may tell; and don't give way to hating, even though others may hate you.
4. Be patient, but don't let waiting wear you down.
5. Dream, but don't make dreams your master; and think, but don't make thoughts your aim.
6. Expecting neither, treat both triumph and disaster just the same.
7. Be strong enough to risk and lose it all, and start again without a word about your loss.
8. Be able to talk to crowds and yet retain your virtue; walk with kings and keep the common touch.
9. Let all men matter to you, but none too much; be strong in the presence of foes, as well as with your loving friends.
10. Live for the moments of wonder, discovery, and joy.

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The rest of this book will attempt to provide some context and motivation for the instructions above, and for some others as well. It is drawn from our "extended heritage." It touches on the philosophical and metaphysical, but its purpose is to remain "down to earth." A body of ideas is woven together. These are important ideas, presented here and elsewhere, each time a little differently. Some of these ideas have been interacting with human designs and behavior for millennia. They can be found in a great diversity of places. This book is simply one more way for them to be combined, and one more opportunity for them to interact with people.

## Myths and Ideas

In the next chapter we will see how *evolution* works, and that it can work not only on living organisms, but on ideas as well. Some ideas are compelling. They speak to people's deeper needs. These ideas turn into our folklore and legend. They are contained in stories, anecdotes, jokes and popular tales told over the back fence, the campfire, and wherever people gather.

Because stories and myths contain one or more compelling fragments of thought, they tend to shape our minds. Successful stories appeal to our needs in some way, positive, negative, or indifferent. The proof of this is that they endure; we repeat them. Experts in such matters tell us that the events in the

following two stories **never happened**. Perhaps not, but both are so very easy to imagine! They illustrate that stories can take on lives of their own!

## An Urban Myth

Urban myths are usually told as "true stories" that happened to a friend of a friend. The person relating the story never has any **direct** knowledge of the events. The following is an example from a hypothetical storyteller.

"A guy I went to school with picked up a girl after her shift was over at Burger Barn. He had first met her there earlier that evening. They began their date by driving around, just talking and getting to know each other. After a while, they found themselves outside of town going down a dark country road with thick trees on both sides. At a wide place, they pulled over and parked.

"The radio was on and they were having a good time getting to know each other. Then a news flash interrupted the music. They learned that a convicted murderer had just escaped from the local mental institution. He was described as having a hook instead of a right hand. He was reported as having escaped into the countryside.

"This suddenly made both of them afraid, especially the girl, and she asked to be taken home. The guy started the engine and roared away with tires spinning. He drove the girl straight home, got out of the car, and went around to let her out. As he was about to open her door, he found a **hook** hanging from it! Blood was still dripping where it had been ripped away from its owner's arm!"

## The Graduate

It was high school graduation. Tom and his father had spent many evenings during the past semester shopping for a car. All of Tom's dreams were wrapped up in the certain knowledge that this evening the car would be his father's graduation present to him. Instead, Tom was shocked when his father handed him a small package which contained a Bible. He was so confused and angry that he threw the Bible down and ran from the house with tears of rage in his eyes.

He and his father never saw one another again. Years later, news of his father's death brought Tom home. The night after the funeral, Tom was going through some of his father's possessions that he was to inherit. He came across the Bible, brushed off the dust, and opened it to find that it contained a check dated the same day that he graduated from high school! The check was for the exact amount of the car that Tom had been expecting for his graduation gift!

## The Hitchhiker and the Gold

A beggar, who had spent the summer in Denver, was hitchhiking south and west toward Los Angeles for the winter. One of his rides ended in the hills of New Mexico. All afternoon he tried to get another ride, but no one picked him up. As the sun was just beginning to set, he noticed a golden gleam from the ground some distance away from the highway. He walked into the sand and sagebrush to see what was there. Lo and behold, it was a gold artifact weighing several pounds and barely able to fit into his pocket. He was overjoyed. It had to be worth thousands of dollars! He couldn't believe his good luck. He felt happier than any time he could remember.

Now, back at the highway, he walked tall in the direction he was headed instead of just sitting beside the road. In the dusky light opposite the setting sun a pair of headlights approached. Out went his thumb and the car pulled over. The driver, incredibly, was going clear through to Los Angeles. How his luck had changed!

Along about four in the morning, he woke up to the sound of the car pulling into a gas station. As the tank was being filled, a group of five motorcyclists pulled into the station. They robbed the attendant of all the money in the cash register and shook down the owner of the car and his hapless passenger. The hitchhiker was forced out of the car and patted down. After he had surrendered his piece of gold, the driver tried to put up a fight to save the money in his wallet. He was badly beaten and his tires and windows were shot out. After the gang had left, an ambulance was summoned. Soon the hitchhiker was back on the road, totally broke again. It was pitch black and cold out; hardly any traffic was coming by.

Surely, this had become the very worst day of his life! His misery was so complete, he would never realize that he had spent almost the entire night in a warm car, was hundreds of miles closer to his goal, and had lived through some interesting experiences since the previous evening.

## The Moth and the Flame

A little boy, knowing the benefits of warmth, once observed a moth fly too close to a flame and get burned in it. He asked his mother how he could know how much flame was good, and where it became dangerous.

His mother gave him a simple demonstration. She took a sheet of paper and folded it into a cup. She filled the cup with water and held it over an open flame. The water was warmed and the cup did not catch on fire. Without the water, the paper would have been burned. Without the paper, the water could not have been warmed.

> The question may be about a mountain, but the answer may be about a rope.

* * * * *

These stories are examples of things we tell each other. Modern thought contains much that is very ancient. In the retelling we bring ideas up to date; they evolve a bit with every generation.

This instruction manual touches on our destiny and our *duty*. It occasionally gives explicit instructions on what to do and how to think. But more important, it weaves the themes of knowledge and human values into a variety of everyday topics.

> The difference between ourselves and our descendants of the far distant future will be their ability to fuse wisdom and compassion to produce *authentic ideas*, ones constructed of both *objective knowledge* and *effective values*.

Later, perhaps this statement will take on more meaning, and we may be able to take a first step down the road it points out.

# I. Foundations

Our reality evolved along with the rest of life on earth. We can speculate, from our vantage point in the present, about a reality before our time, but that speculation is for a different book. Life may have arisen at another time and place than life as we know it, probably under different conditions and with very different results. The complexity of life is such that what it produces is absolutely unique. Quite by chance, the "unfeeling immensity of the universe" did permit life as **we** know it to evolve into **our** here and now. We may have our superiors and inferiors somewhere else in the vast reaches of space, but we are quite certainly alone as human beings. When we know more about how we came to be here, perhaps we can begin to understand our "ancient covenant," our destiny, and our duty.

Long ago, it is conjectured, all the matter and energy that makes up our universe existed as a single thing at a single point in space and time. Then, somehow, it broke loose. At that point, time, not time as we know it, but what eventually **became** time as we know it, began. A fundamental property of time is that it enables us to relate events and make sense of beginnings and endings. However, time itself can start, stop, and run at different rates for two observers according to the accepted principles of physics.

Scientists have defined a pattern that describes the sub-atomic world. It is called Quantum Electrodynamics, or QED. The present forms of atoms and molecules can be derived from this pattern. The complete theory, too complex to explain here, describes many sub-atomic particles, forces, and relationships.

One of the "early events" in the formation of the Cosmos was the necessity for matter and energy to become distinct from one another. The force that connected them became several distinct forces. The point from which they originated became a volume of four-dimensional space-time. And, as the universe got larger and cooler, more and more things settled into their present forms and proportions.

Necessity forced the decision points, often chance determined the outcome. Today's reality is the unlikely result. Tomorrow will be just as unlikely as today. And, as always, it will be the product of chance and necessity.

> Everything in the universe is the product of chance and necessity.
>
> - Democritus

In its first moments, and during all stages of its development, the shape, the rules and codes, the very reality of the Cosmos has been determined largely by *chance and necessity*. Chance determines the particular rules, codes, and shapes that are chosen. Necessity forces the choices to be made. This principle is fundamental to understanding the universe. The concept of *evolution* involving chance and necessity at various crisis points throughout the vast stretches of time past is one that we will visit several more times before we have finished.

# The Theory of Evolution

Evolution, as first described in the last century by Charles Darwin, is one of the most important concepts to emerge from the thoughts and ideas of man in the past several hundred years. The Theory of Evolution is fundamental to understanding the reality of man, and also much of what motivates this book.

Evolution is a natural process of invention and discovery. Many complex systems, over the course of time, may be said to evolve, because their behavior seems to involve an unfolding, or invention, or discovery process of some kind. A system or platform upon which other systems depend, or from which they arise, may be said to evolve out of a series of chance and necessity events. But, we need a more restricted definition of evolution as well. This is the **evolution of an entity**. The following rules apply:

1. Every entity that evolves is created in a reproductive, or copying, process.
2. Every entity has ancestors that it is copied from.
3. Every entity may be copied to produce a variable number of descendants.
4. At least some of the copies made at each generation do not survive long enough to allow copies to be made of themselves.
5. The characteristics possessed by the entities most successful at producing descendants (getting themselves copied) tend to become the dominant characteristics in a population over the course of generations.
6. A copying process may only **approach** perfection. Some changes that affect the ability of new entities to produce descendants (either positively or negatively) are introduced at each generation. This leads to the transformation of the entire population.

"Survival of the fittest" isn't mentioned in these rules, but it does exist between the lines. The most important point is that a *copying process* has to exist. Entities in existence today are copies of earlier entities. Those in existence tomorrow will be copies of today's entities. Each copy may introduce a bit of change. Changes may result in more or fewer copies of the entities that possess them. An entity may be much copied (produce a lot of offspring), and these entities in their turn may be copied even more. And yet all the entities may seem "unfit" in many respects. But this doesn't matter. The measure of an entity's *fitness* is the **number** of its descendants. The fitness of a characteristic is the number of entities possessing it. It's strictly a numbers game, and any other criterion of "fitness" is not really important.

Two questions about evolution are very intriguing. Does evolution have any direction? And, how fast can it go? The answer to the first question is related to the concept of survival of the fittest. If "fittest" did have a clear definition and was responsible for natural selection, then evolution would have a clear direction. But "fittest" is not a clear and unchanging concept. "Fittest" is what best passes through the various selection processes that happen to operate on a particular entity and allow copies to be made of it. Selection operates a bit differently on each entity.

Certain selection processes seem to operate over long stretches of time, others operate for shorter periods. Some selection processes may be very dominant causing rapid evolution, others may have only slight effects and require a long time for significant change. Many species, the dinosaurs being one example, have evolved entities with larger and larger body sizes. Other species have evolved greater

intelligence. The reversal of these and other long term directions seems to occur more often by extinction than by "devolution."

Evolution follows the direction that the operative forces of selection set for it. For some entities, like the cockroach, these forces change very little over long stretches of time. For other entities, like dogs and cats, they change quite a bit. But, the forces of selection are not the only factor that determines how fast evolution occurs. The copying process is the critical factor.

One of the long term evolutionary trends is toward faster change. Several fundamentally different copying processes have been evolved by life on earth. The first of the two major processes still in existence today was the simple asexual division of cells. Sexual reproduction evolved perhaps a billion years after this initial system had been established. Sexual reproduction is a copying process that introduces more change in every generation. It also allows a species to have some "say" in its own evolution, because the **selection of a mate** is part of the **selection process**.

The principles of evolution can be applied to virtually any kind of entity with an information component, it doesn't have to be "alive" in the usual sense. If the entity is incapable of copying itself, it must rely on some other entity to copy it. The principles were derived to explain the origin of living species, but their operation can even be seen in the evolution of, say, a spoken language.

Let's consider this example further: The evolving entity will be a language as spoken by a given human being. Words and ideas are the characteristics of this entity. Human beings reproduce it a word or an idea at a time, continuously, in speech and writing as part of its copying process. The more a word or idea is repeated, the more "successful" it is. Often the copying process (speech or writing) introduces a change. Words are associated with ideas differently, or they get spelled or pronounced differently. The new usage is successful if it is widely copied and becomes more numerous in the population. Unsuccessful words and ideas disappear.

Notice that the copying process for a language is unrelated to the language itself. A language is like a virus, it relies on external help to get itself copied, but the same set of principles explains how living things, and their non-living concomitants (behavior patterns, languages, institutions, styles of clothing, and other artifacts), evolve.

Some of the corollaries of evolutionary theory are:

1. A species is a population of organisms capable of having common descendants (the largest population capable of interbreeding).
2. Over many generations a species may evolve into one or more new species.
3. If parts of a population get separated, each subpopulation transforms independently, and different species may evolve.
4. A species becomes extinct when its population becomes too small to support ongoing reproduction and its last members die.

Some of the beliefs of evolutionary theory with respect to life on earth are that:

1. It took about one billion years for the simplest living cell to evolve from the non-living organic compounds present on earth about four billion years ago.
2. All living organisms on earth had a common ancestor some two and a half billion years ago (give or take half a billion years).

3. Man shares with chimpanzees a common ancestor that lived from four to five million years ago, and with all the primates an earlier ancestor that lived about twenty million years ago.
4. All human beings today are descended from a common ancestor that lived about two hundred thousand years ago.

The term *common ancestor* needs a little more explanation. So do a few other terms such as *population* and *gene pools*. It is a logical consequence of the way the reproductive copying process works for all life on earth that any two creatures are descended from a single ancestor if you go back far enough. You and I are related to an **n**th great grandfather and an **m**th great grandmother, even though we might not know what numbers are represented by **n** and **m** (nor which is the larger). Likewise, that particular ancestor of ours was related to an ancestor of every chimpanzee alive today if we go back another 200,000 generations, or so.

Let's see if this becomes more clear (and more believable) as we discuss some other concepts that tie in. An individual's genes are contained in a collection of chunks called chromosomes. Chromosomes record information. A chromosome could be compared to one volume of a set of encyclopedias. Genes are like the individual articles, or subjects, that are written up in each volume. Genes are written in a language called DNA. Each gene is roughly comparable, in amount of information content, to an article in an encyclopedia. Likewise, each chromosome contains about as much information as a volume of an encyclopedia. Chromosomes vary in size and they contain a complete set of genes in a sequence fixed by chance and necessity (changes introduced by chance in the copying process with the necessity to adhere to a historical template), rather than in alphabetical order like articles may be sorted in an encyclopedia.

A *gene pool* is all the genetic information possessed by a collection of individuals. A collection of individuals is sometimes called a *population*. Populations may consist of all the members of a given species, or some smaller fraction of a species present at a single time and place and able to interbreed. A gene pool contains more information than the chromosomes of a single individual. It also contains more defects. In a sufficiently large gene pool, the defects and omissions in the chromosomes of any one individual are usually correct in some other individual. Also, the larger the gene pool, the greater other differences are, those not due to omissions and defects. A gene **pool** is more **robust**, and contains more **variation**, than the genes of any one individual.

A human being has 46 chromosomes. Each one of our chromosomes is organized like a volume taken from some ancient "encyclopedia." Each chromosome usually comes from a different "edition" of the encyclopedia. There are 23 volumes in each edition. So, each of us has two paired sets of a 23 volume encyclopedia. There is no way to tell which chromosomes come from an earlier or later edition. In general, all 46 chromosomes are a random assortment of volumes from 46 different editions of the "human" encyclopedia. Each volume of every edition has the same basic information, but minor defects, omissions, and other differences exist between any two editions.

No one knows how many different editions are represented in the human gene pool, or in the gene pool of any other species for that matter. In any species, there can't be more editions represented than the number of chromosomes times the number of living entities. That means the upper limit of the number of editions represented in the human gene pool is 46 (chromosomes) times the number of living human beings (about 4 billion people). There is duplication of course, but whether by a factor of 1,000 or 1,000,000 we don't know.

Chromosomes are always paired, volume ones together, volume twos, and so forth. Each volume of a pair is from a different parent and usually comes from a different "edition." Inbreeding (pairing brothers and sisters, for example) makes it more likely that two chromosomes of a pair are identical. The more closely related two individuals are to each other, the more identical chromosomes they share. Identical twins share all of their chromosomes. They are like clones of one another.

The best method science has come up with to differentiate species of living things is by comparing their DNA. Two species that have more of their DNA in common are presumed to be more closely related than a third that has less in common with either. The way new species evolve can be compared to the way tree branches grow. A trunk divides into branches, and branches divide into smaller branches. Branches do not combine at their tips. Three different species are like the tips of three different branches. Two of them generally come from a nearer bifurcation (share a more recent ancestor), and this common branch stems from another bifurcation further away (an earlier ancestor) that is shared with the third species.

If it were possible for two living things to be unrelated by a common ancestor, it would have to be the case that each living entity arose in a separate occurrence of life. Life on earth may have arisen on more than one occasion, however all occurrences but one have long since disappeared. We believe this because the DNA of every living thing on earth has much in common with every other living thing on earth. No exceptions have yet been found. Perhaps someday one will be found here on earth, or will arrive here from another planet or solar system.

If you found a library on another world and began to compare the books in it, you could relate books by how much text they shared with one another. Two books in a completely different language might appear to share no text at all (although, without knowing both languages, you couldn't be sure that they didn't share some of the same ideas). However, if you found whole sentences, paragraphs, and even chapters copied word for word, you could be pretty sure that the two books were related in some way. Either the author of one copied from the other, or both copied from some earlier work. This is exactly what we find with the chromosomes of the living things in our gene pool library here on earth. The DNA language written into every chromosome we have ever studied is the same. In fact, many entire passages of text are the same, even when the most different forms of life we can find are compared.

Consider a population living today. When we say that all of its members share a common ancestor of so many years ago, that doesn't mean that all of them are descended only from that one individual and no other. The gene pool of today's population is derived not just from that single common ancestor, but from the gene pool of the entire species of which that ancestor was a member. Some bits of that gene pool may have been lost, but most will have found their way into today's gene pool (along with the changes, omissions, and mistakes that are bound to occur).

Living things are put into groups, or classified, according to their degree of genetic or physical similarity. When genetic similarity is used, you can picture the *classification* of plants and animals as a bunch of circles embedded in larger circles. The smallest circles represent a single ancestor from which all the members of a single species are descended. Larger circles enclose all the species descended from an earlier ancestor. The circles do not cross or overlap. One big circle represents all life on earth. Completely contained within it, two large circles that don't overlap represent the plant and animal kingdoms. Completely contained within these, are successively smaller circles representing phyla, classes, genera, families, and species. The exact ancestor represented by each circle is largely a matter of conjecture, convention, and precedent set by scientists in the past. This ancestor is known to have existed in theory, but in practice it may be impossible to "dig up" even one of its close relatives.

The scientists in charge of classifying animals have put men and apes into different families. Remember, a *species* is a population that can interbreed. A *genus* consists of several related species. A *family* contains several different genera.

Since a genus usually contains more than one species, and a family may contain quite a few different species, it would be logical to classify man and at least the most closely related apes as part of the same genus. However, we have reserved membership in our "club" exclusively for ourselves. Thus, we and all of the apes belong to nothing less than the Hominoid "super-family." According to the way scientists have decided to classify us, we are the only existing species of the genus Homo and of the family Hominid (the others are extinct, the most recent having died out over 50,000 years ago).

With modern methods of comparing DNA, and breeding experiments that can determine whether two animals belong to the same species, it is relatively easy to classify living animals. But the classification of extinct species is more difficult and more speculative. For one thing, there is no sharp dividing line as one species evolves into another. This is illustrated by the contradiction in the following line of reasoning:

> Every dog had a dog for a mother.
> There have been a finite number of dogs.
> Therefore, there must have been a first dog.
> The first dog could not have had a dog for a mother.

Let's consider another example of this. Suppose we dug up three different skulls. Let's assume that all are some kind of Hominid and that we can date each of them at least a few hundred thousand years apart. Even though we may be able to see differences in the skulls, without a sample of their DNA, we can't be sure which of the following holds true (we can only take our best guess). First, they may be three separate species such that A descended into B and B into C. Second, two of them (A and B, or B and C) may actually be from the same species (if they were both alive at the same time, they could have interbred). And the third possibility is that A was the ancestor of both B and C, but B was not the ancestor of C, it was only an offshoot that became extinct.

Scientists are pretty sure that there were two or three distinct species of Hominids in our direct ancestry back to our common root with other living Hominoids. They are also pretty sure that they have identified Hominids that have gone extinct, such as the Neanderthal (but was the Neanderthal truly a separate species? No one can be sure).

## Our Early Origins

Think of the following as an exercise of the imagination. It is based on some accepted conjectures, but neither it nor any other hypothesis can be proven with the facts we have at hand. This exercise is intended to help us better understand our origins, our human existence, and the principles of evolution that brought us here.

About four million years ago (several hundred thousand generations), a creature lived that was a common ancestor to both human beings and chimpanzees. Think of how different we are from a chimpanzee. Yet, this genetic difference is represented by less than 2% of our DNA! Since we and the chimpanzee evolved in separate directions, we are up to twice as similar to our common ancestor of four million years ago as we are to the chimpanzees of today. Let's imagine some of the events of these last four million years.

First, there were many climate changes. Every ten to fifty thousand years or so the earth has had an ice age. Between ice ages, it may have endured global warming. In four million years, the continental plates have moved up to a hundred miles horizontally, and in some places several thousand feet vertically. The movement of land and the raising and lowering of seas, have allowed the land masses to become connected and disconnected over time.

How does this affect our evolution? It means that there were many opportunities for populations of our ancestors to spread out over the world and become geographically separated from each other. Consider the most recent. The ancestor shared by all mankind is estimated to have lived about 200,000 years ago (give or take fifty thousand years). The evidence at hand suggests that virtually all of the populations in each area of today's world have been there for most of the past 50,000 years.

The evidence suggests two things. One is that there were early Hominids all over the earth from several million years ago up to about 50,000 years ago. Another is that a migration, apparently out of Africa, took place about 200,000 years ago. These people, from which all of modern mankind apparently descended, split into five major subgroups. One migrated into Europe, another into Asia and eventually across the Bering strait to the Americas, a third across Tibet and China and as far as New Guinea, and the fourth across India and on to Australia. An open question is whether these people interbred with the people that already occupied these lands, or co-existed with them for many thousands of years. Were other Hominids absorbed or did they become extinct? Probably both things happened to some degree.

It seems that all differences between the races of modern man have evolved in the past 200,000 years. This period is 1/20th of the time that produced the differences between man and the chimpanzee. The other primates are specialized to certain areas of the world, but man and his more immediate ancestors have spread out all over the world, probably several times.

Today, we are the only living species of the genus Homo and of the family Hominid. We know there were others, and every single one of them was more like us than it was like a chimpanzee. Apes, chimps, and other Hominoids survived, but none of our other, much closer, Hominid relatives did. It's curious.

Mankind migrates. We are capable of adapting to just about every climate and locale on earth. Like us, all of our fellow Hominids were well adapted to a range of climates and locales and were certainly able to migrate when conditions changed. One theory for the absence today of all Hominids other than man is that they were made extinct by our ancestors. It is far less likely that these species, differing from us by less than a percent of their DNA, could have been made extinct by some less capable animal, or by a change of climate coupled with their failure to escape or adapt.

Another theory is that the differences were "absorbed." This could have happened by various migrations occurring as much as 50,000 years apart. Populations in isolated geographical areas tend to evolve genetic differences over periods of several hundred thousand years (like the blondes in northern Europe and the dark-haired people in the Mediterranean). But a small percentage of people move around continuously, and occasionally migrations involved a larger population. Sometimes this enables differences to be absorbed or mixed together again (perhaps like what happened when the Romans invaded what are today the British Isles). Certainly the English speaking people of the world are the most ethnically diverse of any people united (or is it separated?) by a common language.

It is likely that both war and migration played a part in our long term history. We are a strong species. We are the survivors. But some of the strengths that have left us as the current "stewards" of this planet might be seen by some as "skeletons in our closet."

Civilization is a relatively new invention; some of the more basic parts of our nature have been around much longer. An example from today's popular press will bear this out. In news from Africa, a severe drought is taking place. As a result, hundreds of antelope and other wildlife have begun to weaken and die. Hippo and crocodile face starvation. Lion, leopard, and hyena have started killing each other over shrinking water bearing territory.

> If you can divorce yourself from the impulse of sentiment, drought is really a very beautiful process. We are going to have losses of animals, but it is a natural process affecting young, old, and injured. You get a purification of the gene pool. It's a rejuvenating process.
>
> Salomon Joubert, Director of Kruger National Park

Does this principle also extend to people? Many have died by famine in Europe, Asia, and Africa, recently and over the years. A smaller gene pool might be more "pure" in some sense, but it's a weaker and less robust gene pool. What makes this concept appealing to some?

In other news, leaders of the Serbs explained their campaign against Bosnia as simply "working away at some ethnic cleansing." This phrase reminds one of the Nazi slaughters of World War II. Violence isn't always involved, however. As soon as Americans had expelled the Iraqi invaders from Kuwait, the Kuwaitis themselves had begun their own job of "ethnic cleansing." Estonians are revoking the citizenship of ethnic Russians, trying to cleanse Estonia. The Japanese are still denying full citizenship to Korean ethnics, even after some of them have lived in Japan for over three generations. Examples of this, many of which are **much** closer to home, go on and on.

These attitudes — this behavior — may horrify us, but its practice is almost universal. It has surely played a major part in the past several million years of our history. It is one of the many aspects of our human heritage. The "human condition" of today is derived from our history and heritage of the past. There may be things we would prefer to ignore in our pasts, but they are reflected in our present selves. To better know ourselves, there may be unpleasant things we have to face.

* * * * *

Evolution is as much a "universal law" as gravity. It is a slow, inexorable process that gathers information; it is the development of order out of chaos. And the most advanced result of evolution on earth is not a human being, but **human society**. Thousands of years ago, our society stepped up its pace of increasing complexity. Now, it has overtaken us. It is literally more complex than we are. It is a higher life form.

This instruction manual is an attempt to help you understand the "human condition," not so that you can go out and "improve it," but so that you can work within it and succeed **as an individual**. It is only through **your** success that you can contribute to the success of our species, enabling our species to contribute to the overall success of life on earth.

## Wisdom, Logic, and Common Sense

Wisdom is not something you can prove, and instructions derive from a matrix of knowledge and experience that may not be coherent when its parts are put under a microscope. But, wisdom is

nevertheless something to be sought. It is made up of logic, common sense, and more. Logic is something that **can** be proved. And common sense is what **integrates** a matrix of knowledge and experience.

This instruction manual is written from the point of view that there is a big difference between giving a man a car and teaching him how to drive. If it seems in places that you are being told **what** to think, consider it only as an example or an analogy. The important thing is to learn **how** to think. This is the key to interpreting our perceptions and determining our behavior. It is important to accurate thinking to be able to use the principles of *logic*.

Logic proceeds from assumptions. Always question assumptions, but more important, know that they are necessary and try to work out what they are. Social interactions are guided by rules. Rules should also be questioned, but keep in mind that rules need to exist. Find them out and be aware of them. Rules and assumptions can change.

Do not look for logic **in** a set of rules or assumptions (it follows **from** them). Follow the argument or play the game and then decide whether the assumptions or rules should be changed (or did change while you weren't looking).

Logic is the process that guides reasoning. Two formal approaches that employ logic are inductive and deductive reasoning. Let's take an example of each. Inductive reasoning begins by observing a pattern of some type, often a sequential pattern. A simple example might be the sequence 2, 4, 6, 8. What is the next number in the sequence? You would probably answer 10. The numbers increase by two. With a simple sequence like this, you should be confident that you could answer with the number following any number you might be given. But, how about the sequence of letters O, T, T, F, F, S, S? What's next in this sequence? Many people, when given this puzzle for the first time, fail to grasp the pattern that connects these letters. It's not obvious that this is a sequence of numbers and that E is the first letter of the next number in the sequence.

*Inductive reasoning* involves assumptions. With the right set of assumptions you may arrive at the right answer, but if there is a mistake in your assumptions, as there often is in real life, you may arrive at the wrong answer for the "right" reasons, or the right answer, for the "wrong" reasons. Is the sequence 1, 2, 3 followed by 4 or 5? If we assume that 1, 2, 3 means we are counting by ones, then 4 is correct. But, if we assume that 1, 2, 3 are the first three prime numbers (a prime number is a number that can be divided evenly only by itself and 1), then 5 is the correct answer. In this case, as in most cases, a small number of data points is not enough to establish a pattern. In the general case, however, it is not possible to know that we have enough data points to establish a unique pattern. So, we have to proceed with caution.

*Deductive reasoning* is a process that makes its assumptions more clear and discovers a pattern (or answer) by showing that it follows logically from the assumptions. One doesn't somehow grasp a pattern and predict on the basis of it, the pattern itself is deduced from the assumptions. If the deductive procedure and the assumptions are correct, the resulting answer or pattern is correct. Here are a couple of examples.

Given an 8x8 grid, can you cover it two squares at a time with 32 dominoes? This seems easy enough. Just do it. You can put the first domino in one corner and extending along one side. The second goes next to it along the same side. The third and fourth complete that side. In the same way, the second row is covered by another four dominoes, and the third through eighth rows are each covered as well. Four dominoes per row times eight rows takes a total of 32 dominoes. By showing we can do it, we

arrive at the correct answer, “yes!” Now, suppose that two squares are omitted from the grid, the lower left and upper right (opposite diagonals). Now, can you cover the grid with 31 dominoes? Heartened by recent success, you might try to do it again. This time, after trying several approaches, you will fail. So, is the answer, “no”? This would be called jumping to a conclusion. Can you **prove** that you’ve tried every possible way to cover the grid?

There is a simple way to prove that the answer is “no” by using deductive reasoning. Color the grid like a checker board. Now, notice that the opposite diagonals are the same color. When a domino is placed on the board, it always covers two squares of different colors. It **must** do so. Therefore, since the board contains 30 pairs of opposite colors and one pair with the same color, we can conclude that we can’t cover this last pair. So, by deductive reasoning, we can confidently answer, “no!”

Let’s take another puzzle. Suppose you have a block of cheese in the shape of a cube and your task is to cut it into 27 small cubes with as few cuts as possible. How many cuts would that be? Step one might be to see if you can cut it into 27 pieces at all. This is easily done by making 2 cuts across the top of the block, turning the cheese 90 degrees, making 2 more cuts, then flipping it over on its side and making a final two cuts. With 6 cuts, the 27 small pieces have been produced. Now we know that it can be done, and no more than 6 cuts are necessary. Can we do it with fewer cuts? Can we prove (with sound, deductive reasoning) that a certain minimum number of cuts is required?

It seems logical that fewer cuts would require cutting through more cheese with each cut. After the first cut, the two pieces could be arranged so that the next cut would go through four layers of cheese instead of only three. Then the new pieces could be stacked so that the next cut goes through even more. This seems like a good idea. But, when you try it out, it still seems to require 6 cuts. There are, again, a lot of possibilities. If you can prove that you have tried them all with negative results, you have proved the case. But if you reason from just a few of them, you will have again jumped to a conclusion. Here is how deductive reasoning solves the problem.

Consider the 27 small cubes produced by 6 cuts that only required rotating the cube after each cut. Each cube has 6 faces. Now, ask the question, “How many faces of each small cube are produced by cuts and how many come from the original cube?” Each corner cube requires three cuts to separate it from the original large cube. There are 8 corner cubes. Between each corner cube, along the edges of the large cube, are another 12 cubes that only share 2 faces with the original large cube. That means that four of their faces are new cuts. Likewise, at the center of each face of the large cube are six small cubes that only share one face with the original cube and require five cuts to define the rest of their faces. This gives a total of 26 small cubes. Finally, in the very center of the large cube is a small cube that shares no faces with the original cube. All six of its faces require a separate cut. There is no way that a cube can be stacked on itself, after all, so there is no way to cut two of its faces in a single swipe. This observation is the proof we need to state with confidence that a minimum of six cuts are required.

Logic is useful to guide and sharpen your thought processes. Logic is useful to interpret and understand someone else’s argument, or to construct one of your own. Apart from communication, logic should play a part even in thoughts that you share with no one.

Logic is a way of connecting and extending factual statements. Our language has three common types of expressions: factual statements, questions, and commands. Even questions and commands (instructions) may contain a factual implication or component.

## True or False?

It might seem as if a factual statement is either true or false. If we can show that it is not false it must be true and vice versa. But, this assumption, sometimes called "the law of the excluded middle," is not borne out by experience! What else can a factual statement be, if not either true or false? Consider the statement,

> This statement is false.

It is neither true nor false! It contradicts itself. How about,

> This bachelor is married.

It also contradicts itself and is therefore nonsense instead of being true or false. Thus, we can't exclude this middle ground between true and false. Another way a statement may be neither true nor false, is when we simply don't know, or can't know, whether it is true or false. Some statements may be very easy to make, but their proofs may require a very large number of steps, or even an infinite number of steps. Later, an example of each of these types of statements will be given.

Sometimes a statement is called a paradox. If we accept it as true then we may go on to deduce something we know to be false. And yet the flaw in the statement may not be obvious. A classic paradox is the statement "The Barber of Seville shaves every man who does not shave himself." The question then is, "Who shaves the Barber of Seville?" If he shaves himself, the original statement is untrue. If another shaves him, then it is also untrue. Therefore, though not obvious at first, the statement contradicts itself. Or does it?

While you're thinking about that, consider this,

> A boy and his father had been in a car crash. The father was killed and the boy now lay on the operating table. The surgeon came into the operating room, looked down, and recognized the boy. The boy was the surgeon's own son!

Is this possible? This type of statement brings up a further refinement in the classification of statements. By their very construction, a statement may be possible or impossible, it may be necessarily true, or true only if certain conditions are met. The above statement is possible assuming that the attending surgeon is the boy's **mother**. This raises the possibility that the Barber of Seville might also be a woman!

## Logic and Data

Four approaches have been commonly used to guide the human thought process. These approaches differ on the basis of whether they use *logic* and *data*. We will see below how both data and logic should be used. When both data and logic are used properly, a scientific approach results. Here is how all four systems relate to the use of logic and data

| | | Logic Used? | |
|---|---|---|---|
| | | Yes | No |
| Data Used? | Yes | Science | Empiricism |
| | No | Rationalism | Mysticism |

Some approaches use either logic or data improperly. This creates a "pseudo" system of some kind. However, when logic and data are used **properly**, or properly **not used**, a legitimate system results. When possible, it is best to use both logic and data. However, there **are** times when their use is not possible or proper.

Empiricism and Rationalism do not have to be competing opposites, when necessary they can be melded nicely into science. Science and Mysticism are also not antithetical, one may complement the other. Without revelation and intuition, we would hardly be human.

In the first part of this book, we will focus on joining logic and data into the scientific method. First, let's learn a little about logic and data. To keep this "short course in logic" as short as possible, we will only consider the logic of arguments, claims, and implications. For example,

> This pain killer contains twice as much of the ingredient that doctors recommend most.

The implication is "this pain killer must be twice as good." But why? If doctors recommend it most, it's possible that it's better. But, I can take any number of tablets. In fact, if I wanted only half the dose, this pain killer would force me to split a tablet in two. A pain killer with a smaller dose might make it easier to swallow and control the amount. So, my conclusion ought to be that "this pain killer" is actually worse, because it's less flexible.

Consider a simple claim: "John loves Mary." There are several statements that are related to this statement, each of which has a special name. The *converse* is "Mary loves John." The *denial* is "John does not love Mary." The *opposite* or *contrary* is "John hates Mary."

The truth of a statement bears no relation to its converse. Just because John loves Mary, it need not be true that Mary loves John. A statement and its denial can't both be true. John can't both love and not love Mary. The denial of a statement is a necessary, but not sufficient, condition for its opposite. In other words, it is necessary that "John does not love Mary" for it to be true that "John hates Mary." All of these rules assume that the truth of the statement can be determined. If the statement lies in the "middle" then all bets are off.

The classic way to relate the *necessary* to the *sufficient* is with implications. "Wood will catch fire if and only if it is hot enough and oxygen is present." This statement lists two conditions, each of which is necessary, and both of which are sufficient for wood to catch fire. Some implications can be derived from this statement. "The wood caught fire" implies that "it was hot enough," and also that "oxygen was present."

One of the simplest formal arguments is the *syllogism*. It consists of a major premise, a minor premise, and a conclusion.

> All climbers are strong.
> Jill is a climber.
> Therefore, Jill is strong.

Consider a claim that has the form of a major premise: "All rulers are powerful." There are three forms of the *obverse* of this statement, all equally as true as the original. "No rulers are weaklings." "All weaklings are not rulers." "Everyone is either not a ruler or is powerful."

The point of all this is to examine how arguments and claims are constructed so that we can get at the sense of them and determine whether they are true, false, or nonsense. In this morning's paper I read the following statement:

> If there were a substantial increase in the number of abortions, it still would not follow that fetal tissue transplants research and therapy should not occur.

I had trouble understanding it. Since all of the following are different ways to say the same thing,

| | |
|---|---|
| If A then B | (B follows from A) |
| A implies B | (A does not necessarily follow from B) |
| A is a subset of B | (B is not necessarily a subset of A) |
| All A's are B's | (some B's may not be A's) |
| B is necessary for A | (A may not be necessary for B) |
| A is sufficient for B | (B may not be sufficient for A), |

it seemed logical to analyze it along one of these lines. The first thing that might help put the statement in one of these forms is to remove the double negative from the second clause and be convinced that the statement still says the same thing.

> If there were a substantial increase in the number of abortions, it would still follow that fetal tissue transplants research and therapy should occur.

Now it seems to have the form "B follows from A," where B is the "research and therapy" and A is the "substantial increase in number of abortions." In other words,

> If the number of abortions were to increase substantially, research in fetal tissue transplants and therapy should still occur.

In the context of the article this finally begins to make sense. The author is worried that abortion related research and therapy might actually **cause** an increase in the number of abortions, and therefore wants such research stopped. The sentence under analysis was a quote from the researchers (representing an opposing point of view) stating that research should continue whether the number of abortions increased or not.

In general, let's say that someone presents us with a statement, argument, or claim. What can we do about it? There are three logical courses of action:

1. Accept the claim, believe in it, and act upon it.
2. Reject the claim, disbelieve it, and base no action on it.
3. Put the claim aside as irrelevant, temporarily or permanently, and base no action on it.

If a claim is temporarily in category 3, it needs further proof or disproof. Either you can work to put it in one of the other two categories, or you can await developments. A claim is permanently in category 3 if it is an empty claim or is incapable of proof.

There are two steps to arrive at one of these outcomes.

1. Examine the claim:

   What assumptions are being made?

   Do the assumptions support the claim?

   What logic is used to formulate the claim?

   Is there a mistake in the logic?

2. Question the evidence:

   Could **any** evidence disprove the claim?

   Does the claim take into consideration all of the available evidence and treat it fairly?

   Could others gather similar evidence and would they reach the same conclusion?

   Does the weight and quality of the evidence match the "surprise value" or impact of the claim?

If a claim passes both tests completely, put the claim in Category One. If there is anything wrong with the assumptions or logic of a claim, it may be clear that the claim is false and we can put it in Category Two (unless and until the logic and assumptions are fixed). But, what if it fails one of the tests of evidence?

If a claim can't be disproved, what good is it? It may have some compelling explanatory power, but this is exactly what we have to sort out. For example, people used to believe that a substance called phlogiston was released when things burned. Now we believe that when things burn they combine with oxygen. It is impossible to prove that phlogiston doesn't exist. You can't prove that anything doesn't exist. You **can** prove that something **does** exist, oxygen for example, by getting a sample of it or a confirmed observation of it.

The phlogiston theory was never disproved, it was overturned in favor of a better theory. The reason it lasted as long as it did was because at the time it was a compelling explanation. The fact that it was incapable of disproof was not important to science at that time. It was then discovered that the byproducts of combustion weigh more than a substance does before it is burned.

Science took a step forward when this was considered. If burning were an **escape** of phlogiston wouldn't the byproducts weigh **less** than the original substance? But, suppose another substance, like oxygen, were being **added** in the process of combustion. Eventually, oxygen was identified and people gave up looking for phlogiston.

Put a claim that can't be disproved, even if it has some compelling explanatory power, into Category Three (permanently).

Let's say the claim could be disproved by some possible observation or evidence. Someone says, "The sun did not rise this morning." Maybe it's cloudy outside and you can't refute this claim by seeing that the sun is up, but if it weren't cloudy you **could** do so. Maybe it's past sunset and you missed your chance to see the sun, still it's possible for someone else to have done so. This claim **can** be proven false, even if you can't do it yourself, so it passes the first question of the evidence. Let's take the next question.

How has the evidence for the claim been treated? Often a claim is part of someone's pet theory. People crave explanations. They also crave recognition. One way they can get both is to discover a new explanation. It's hard for people to gather an adequate amount of data and treat it fairly. The

reason is that no amount of data can ever **prove** a claim. Evidence either supports a claim or disproves it. Evidence is either neutral or hostile.

Someone who presents evidence in lieu of proof, or seems to welcome only evidence that supports a claim, has to be suspect. Such claims need to be put in Category Three (at least temporarily) until you are convinced that the evidence is credible, impartial, and has been interpreted properly.

If evidence comes from a one time observation, a claim must be put into Category Three. Important claims must be verified. Trivial claims may be accepted according to the reliability of the witness, but then they are only "weakly" Category One. Eye witnesses have certain well-tested and documented weaknesses. People are capable of hallucination, self-deception, and iron-clad belief, all at the same time. Witnesses can be led, they can be rehearsed, and they can sense what others want them to say. All this can happen without their knowing it. They can **truly believe** that the testimony they are giving is the truth, the whole truth, and nothing but the truth. A lie detector could easily confirm this. And yet there are many ways that eye witness evidence can simply be false.

Finally, the more the impact of the claim or the greater its "surprise value" or consequences, the greater the evidence required to support it. If someone says it's snowing outside and it's winter in New York, you may feel it's not necessary to check first and then go fetch your coat. You might just take your coat with you on your first trip to go outside. Here the claim is trivial and the consequences of taking your coat are not serious, even if it turns out that it's not snowing.

However, if someone claims that he has a system for roulette and wants you to invest a thousand dollars for the secret, you have an entirely different situation. Here you are headed down a path likely to be filled with bafflement and baloney. You'd like to believe him. You could make millions! But, you don't want to pay a thousand dollars just to find out. You might be facing a thousand dollar task just to make an accurate **assessment** of the system. So, what **will** you do?

First, ask questions about the system to see if it's anything that you could learn and put to use. If not, forget it. Otherwise, if you live in Nevada, invite him to demonstrate at a casino of **your** choice with some of **his** money. If you live elsewhere, bet him $5000 that he can't go to Nevada and make $5000 in front of you at a public casino in two days. If he wins, he's $10,000 ahead minus the cost of a two day trip and he gives you the system. If you win, you are $5000 ahead, and you don't care about the system.

The theme here is to control the situation and gather evidence that can be used to understand and support or disprove their claim. If you listen to their polished pitch, they control the situation and you learn what they want you to learn. A professional evaluation of their evidence, so that you can put their claim into Category One or Two, is very likely to cost you much more than their asking price.

If there is little at stake it doesn't hurt to mistakenly put a claim into Category One. If there is much at stake it doesn't hurt to mistakenly put a claim in Category Three. But, don't make a habit of this kind of mistake, just to be a "nice person," because, over time, these misclassified claims build up as litter on the landscape of your mind.

## Believers and Skeptics

"It takes all kinds." Some people have no use for logic, they hold firmly to the beliefs of their group or their authority figures. They differ by how easily they are persuaded, some being credulous, suggestible, pliant, and susceptible. Others exist at the extreme far end, being zealots and fanatics,

absolutely certain and unshakable in their beliefs, no matter who gives how much or what evidence to the contrary. Believers are more sensitive to the feelings, ideas, and information they receive from those they trust. They place less trust in themselves to question and decide issues for themselves. They are uncomfortable in reaching an opposing point of view, so they don't follow a process that makes this likely to happen.

Most people tend to be credulous, pliant, and suggestible early in their lives. These are characteristics of children. Therefore, children tend to be believers. As children grow up, they may learn other ways of thinking and put them to work. Some people tend to rely and remain consistent with their group, others tend to be more self-reliant. These differences determine how long into their lives a person remains a pliant believer, whether they fossilize into a fanatic or zealot, or whether their credulity begins to be offset by skepticism.

Some people develop into cynics. An extreme cynic is a kind of fanatical **unbeliever**. Cynics tend to believe that humans are motivated entirely from self-interest. Sometimes they develop captious personalities, bringing an element of confusion with them. They may argue in order to entrap and entangle, with an ill-natured inclination to find faults and raise objections. Cynics are the opposite of believers.

Just as believers range from the mildly credulous to the fanatic, skeptics can span an entire range. An extreme skeptic is someone who won't believe anything. Skeptics always reserve a margin of doubt for any statement of fact, but an extreme skeptic reserves such a large margin of doubt, that most knowledge is of no use to him at all.

A normal skeptic was probably a believer at one time, but then learned to be more independent of others and question things. An open and accepting mind, together with a willingness to work at knowledge, results in a the balanced approach of a normal skeptic. Skepticism has been called the method of suspended judgement. It is a belief that all knowledge contains some uncertainty. It tends to weaken the religious beliefs that are primarily factual in nature, but it need have little effect on those that are moral and ethical.

Studies have shown that skeptics tend to more accurately judge the preponderance of evidence and be swayed in their beliefs by it. Conversely, studies have shown that believers tend to adopt a hypothesis-testing strategy in their approach toward logic and data (science). This means that they **adopt** a hypothesis, **then** gather data to test it. This leads to subtle mistakes in procedure, and to pseudo-science. The hypothesis is supposed to come **from** the data, and subsequent testing must gather data in a very careful way to insure a lack of bias. It has been shown that a hypothesis can be completely arbitrary and, as long as there is enough ambiguity, the positive bias of a believer will **always** result in confirmation. This is exactly why parapsychology was a "science" for so long.

Knowledge isn't worth much that isn't continually tested and checked against reality. "He who tastes, knows!" But, he who takes a drug, or has an experience in a state of euphoria, may not know what he knows. The reality check is absent.

## Reality

Reality consists of three aspects. The following are not perfect words for these, but they will do for now: Existence, Interaction, and Information. Each is explained in more detail below. Reality, as a whole, is considered to be either objective or subjective.

You and I each have our own subjective reality. Subjective realities interact. Your reality, my reality, and others connect into **more and more objective** realities. Let's begin with what we know: Subjective reality.

Subjective reality is centered in time. Yesterday is real because of its effects on the present. Tomorrow is real because of the inevitable consequences of today. What **must be** is an extension of today's reality, but what **may be** is imaginary until chance and necessity force one unlikely outcome to be chosen over all of the other unlikely outcomes.

Subjective reality is also centered in space. Just as reality has a past and future "horizon," it also has a size and distance horizon. As *subjective* realities are combined to produce ever more *objective* realities, each new connection takes us further into space and time, adding less and less that is relevant and significant to us.

Within objective reality, the totality of time and space, we become completely insignificant. Some philosophers appear to believe that God's **subjective** reality is, in effect, our **objective** reality. Let's lay that issue aside and consider the three aspects of **our** subjective and mutual reality.

## Existence

Existence is the most fundamental aspect of reality, it is based on particles of matter and quanta of energy (two versions of what, in their own reality, may be the same thing), and how they relate to space. Existence is the physical aspect of reality. Physics is the study of the fundamentals of *existence*.

Existence is static form and potential. It is the distribution of matter and energy throughout space. It is not particularly localized. There is little (if anything) to distinguish between subjective and objective existence. But, existence, by itself, is not enough to define reality. It falls short in two respects.

First, existence does not explain the "fullness of time." Physics may define and use time in many of its explanations, but it does not explain how new things actually come into existence over the course of time.

Second, existence does not give us a way to explain the difference between the concepts of objective and subjective. A series of cartoons once illustrated this. The statement is made that parallel lines meet at infinity. This is disputed, so the two characters set out to prove it. Each takes a stick and draws a line on the ground. They walk along side-by-side drawing their lines until they are far away from their starting point. Then, the first character points back and shows that the lines do merge at the horizon. This seems astounding to the second character, so he retraces his steps and sure enough, when he gets back to the starting point, the lines are found to be quite separate. But, he accidentally turns around and looks in the other direction. Now, the lines meet at **that** horizon!

## Interaction

While existence is based on the distribution of things in space, *interaction* is based on events that take place over time. It involves change. Interaction requires existence, but it is an aspect of reality that emerges as a consequence of the fact that existence is not static. Together, existence and interaction form the basis for a simple, objective reality. But, out of this reality new things can evolve.

Simple interactions among particles and energy are objects of study in physics, but interaction has a different order to it than mere existence. Other physical sciences, chemistry and astronomy for

example, study properties that arise from interactions and patterns of matter and energy. Interaction is the dynamic, systemic, and chaotic aspect of reality.

Interaction can be measured from the simple and mechanical, to the complex and chaotic. Physics has traditionally been limited to the study of mechanical interactions and predictable systems. Chaotic systems have only recently been recognized as such, but some of them have been studied for years. For example, both thermodynamics and quantum mechanics are probably studies of chaotic systems. Chaos is discussed further in the next chapter. We will see that it is not the opposite of order, nor is it the same thing as complexity.

For now, we are more interested in both order and complexity. Under the right circumstances, the third aspect of reality emerges. Very complex interactions begin to involve both order and complexity in the form of *information*.

## Information

When a tree falls in a forest, energy is transmitted through the air. If the energy is translated into the fact that a tree has fallen, that's *information*. This event needs a listener. Does the tree falling make a sound if no one is around to hear it? The answer depends on whether we define **sound** as energy transmitted through the air, in which case the answer is yes, or as information, the sound **of** something, in which case the answer is no.

Science began the study of information by noting its relation to *entropy*. Entropy is a measure of how matter and energy are distributed. The more mixed up and random, the higher the entropy. Information also depends upon the arrangement of matter and energy. In general, if entropy increases, information is lost. If entropy is higher, it takes more matter or energy to record the same amount of information.

Entropy is important (and only well defined) for *closed systems*. A closed system is one whose boundaries are not crossed by any matter or energy. Information is important to *open systems*. It must cross boundaries to play an active role in reality.

Information spans a range, from the stuff encoded in our genes, to all the knowledge and wisdom encoded in our brains. Our language and all of our written works form populations of information.

* * * * *

At the beginning of this discussion on the nature of reality, I mentioned that the words Existence, Interaction, and Information were not perfect words to describe the concepts I had in mind. Now, let me elaborate. The word *pattern* can be used to describe both static and dynamic relationships. Relationship plays a part in all three aspects of reality. Pattern denotes a configuration of relationships. If a pattern is **static** for some period of time, it describes the concept I wish to attach to the word *existence*. A **dynamic** pattern, a sequence of relationships or events that can be repeated with a similar outcome, is a very important part of the concept I wish to attach to the word *interaction*.

When just the existential aspect of reality is considered, there is little distinction between objective and subjective. Where would you draw the line? Time must also be included in reality, and therefore interaction. When interaction is considered, lines become easier to draw. It becomes reasonable to consider systems, and whether they are effectively open or closed. However, when all three aspects of reality are considered in its definition, reality becomes a subjective concept. Information requires an observer, a living, if not intelligent, entity. My belief is that life must lurk behind intelligence — that

intelligence implies life. Life introduces the information aspect to reality, and intelligence puts the seal on it.

This book explores our individual realities, our mutual reality, and the reality of human beings on planet earth about to enter the third millennium A.D. Now that we have defined the nature of reality, let's take on the "big one." Let's try to define life itself. This has been attempted many times. The dictionary defines life as a quality, principle, or force that distinguishes an animate or live thing from an inanimate or dead thing. Let's try to do better.

## Life

*Life* is the state of being associated with an open system that is able to convert outside energy into information, and assimilate, store, and use that information to interact with its environment. Life implies the use of information, and the use of information implies life.

As far as we know, life always comes into being through a gradual process of evolution. When the use of information emerges, life itself has emerged. The key concept here is the **use**, not existence, of information. We will discuss information in more detail later.

This definition distinguishes alive from dead, because death implies the loss of the ability to use information or convert energy into information. As long as a part of a living organism, separated from the whole, retains the ability to create and use information, even on a biochemical level, it is alive. Notice that an organ, donated for transplant, is still alive or viable as long as a sufficient percentage of its cells retain this ability. As larger numbers of them lose viability, the organ as a whole loses the ability to be restored as a working, information processing, component. The organ as a whole dies before the last of its individual cells. Each component has an information processing function on behalf of a larger system. When the ability to carry on that function is lost, the component is not *viable*. This is just the beginning of an exploration of these concepts. We will touch upon them again.

Artifacts, such as tools, shells, and webs, may serve a purpose and have an information aspect for their maker, but lacking the ability to create and use information, they are not alive. Machines, such as computers, are artifacts that may appear capable of handling information, but the interpretation and meaning is only real to the living user. The machine itself transforms and transmits energy, it does not create or use information.

This situation may be changing. At some point, machines may evolve beyond mere artifacts, perhaps to be alive in their own right.

## The Game of Life

The **game** of Life was invented in 1969 by John Conway at Cambridge University. A few years later it was written up by Martin Gardner in Scientific American. It is a classic, because it shows the behavior of *cellular automata* in a simple and graphic way. It is a very simple analogy to the growth process of living cells. Perhaps it will afford an intuitive perspective on life to complement the logical one we have just glimpsed.

There are just three things that you need to know about cellular automata: Their basic unit is a cell, each cell works only with its immediate neighbors, and the behavior of each cell is completely automatic and predetermined (given any situation the cell always responds in a "programmed" way). A cell is

nothing more complex than whatever it takes to carry out its programmed behavior and interact with its neighbors.

Biological cells operate in three dimensions with many neighbors. The game of Life takes place in only two, and each cell has only eight neighbors. Each cell in the game of life operates on the basis of four simple rules. It is unknown just how many rules guide the behavior of living cells, but evolution is probably inventing new rules all the time.

The fascination of this game is that such a simple paradigm could generate such endless and unpredictable complexity. The game must be run by computer simulation to be appreciated. A computer screen is divided up into as many cells as will fit on it. The cells are like squares on a piece of graph paper. To start with, some of the cells are made "live" and all the rest are empty. Live cells are points of foreground color on the screen and the rest is background.

"Life" is a sequence of "generations" displayed as fast as the computer can process them. Each cell or square on the screen is surrounded by eight others (think of each cell as the center of a tic-tac-toe square). If a cell is alive and exactly two of its neighbors are alive, that cell survives to the next generation. If one or none of its neighbor cells are alive, that cell "dies from loneliness." On the other hand, if a live cell is surrounded by three or more live cells, it dies of "over crowding." Finally, if an empty cell is surrounded by exactly three live cells, that cell is born (becomes alive) in the next generation.

Several observations about Life make it a good object lesson for our intuitions about organic life. First, there is no way to predict what will happen after many generations. Given some starting pattern, without actually running the simulation, no one has figured out a general way to predict what will happen. Some very simple patterns expand for a very long time, some stabilize into various length cycles that repeat forever, and others die out entirely. Certain initial conditions (that can only be determined by trial and error), lead to various interesting behaviors. A simple pattern called a "glider" travels across the screen in a cycle that repeats the same initial pattern, but shifts it on the screen. Another pattern, called a "glider gun" cycles in place and emits gliders. Yet another even larger pattern moves across the screen like a steam engine, leaving small patterns behind it like puffs of smoke. The possibilities are endless.

The initial pattern used to start the game could be likened to the information in our DNA. It determines how the game will mature. When you watch a simulation in action, one of the first things you notice is that "clumps" develop and some of them move around. This means that they collide, and then something new happens. Often the two clumps just break up and die, but sometimes a new and stable pattern emerges.

In living cells, our proteins and complex organic molecules are like the clumps. The DNA of all living things has been evolving for several billion years, so patterns have been selected that produce very stable "clumps" that collide with one another in ways that contribute to the growth, longevity, and reproductive abilities of the overall organism. Patterns that go "poof" don't last very long under the pressures of evolution.

## The Meaning of Life

So far we have discussed the definition of life and have tried to gain some insight with an analogy to life. But, the term "life" as used in the title of this book is not the subject of some scientific investigation, it

refers to our own personal life. It's the theme of the book. Its introduction can't be complete without giving it some meaning beyond a mere definition.

An old cowpoke, played by Jack Palance in "City Slickers," said that the meaning of life was "just one thing." And when Billy Crystal asked what that might be, the old cowpoke replied, "That's what you have to find out for yourself. But, you pay attention to that, and nothing else matters."

The point is, life has a different meaning for each of us. A single meaning does not "fit all." Life is evolving. New meaning is being discovered all the time. There is no single answer to the question, "What is the meaning of life?" But, there may be an answer to the question, "What is the meaning of your life?" And that question can only be answered by you. The answer for each of us comes from within.

Even then, the answer can only come when we are ready. What is within us wasn't always there, it grew there, and is still growing. It grows because of nourishment that came from the outside world. At some point it is too soon to turn within ourselves and seek the answer. It isn't ready yet. Eventually, it is too late to make any difference.

A certain amount of truth is contained in what the old cowpoke said. First, you have to discover for yourself the meaning of your own life. Second, when you have done so, you have to focus on it to the exclusion of everything else. This doesn't mean that we should all become monomaniacs or fanatics about something. Let's admit that the meaning of life may be every bit as complex as we are, and that it may incorporate a vast array of things.

The meaning and value of human life are the central questions of religion and philosophy. Many have argued that human life **must** have value and meaning, and that can **only** be so if there is both a supreme being and an afterlife. It is logically impossible to prove the non-existence of either of these, but neither is there adequate evidence to **support** their existence. What we do know for sure is that we have the ability to **invent** meaning and value, and there is reason to believe that one of the purposes of life can be exactly that.

The responsibility is on us to find meaning in our lives. It is not something dictated by *God* or Nature. We can't expect to find it in an *afterlife*, either. We can only count on discovering it in this life and in this reality. This is what is meant by the quotation that began this book: "The *ancient covenant* is in pieces."

Let's leave this for now and return to it later when our thinking processes are really warmed up, and we have shared some of the other aspects of life from the point of view of an instruction manual.

## Some Thought Exercises

So far we have thought about the nature of life, our distant past, and how we came to be here. Now let's take on some diverse topics for the sole purpose "exercising our thinking process." These will include some subjects of scientific investigation as well as some classical "thought experiments."

Keep in mind that the "purpose" of this chapter is to spread out and put together some building blocks. Later on, we may find the blocks themselves, or the exercise of putting them together, to be useful.

## Maxwell's Demon

Maxwell was a 19th century physicist. He proposed the following thought experiment. Suppose a tiny demon were the gatekeeper at a tiny gate between two rooms filled with 72° air. When the demon sees a fast molecule of air flying toward his gate from room A, he opens his gate. When he sees a slow molecule of air coming toward his gate from room B, again, he opens it. Otherwise he keeps the gate shut and any molecule coming toward it simply bounces back. Over a period of time, room A would cool down and room B would heat up. If a demon can do this without any expenditure of energy, it would violate the second law of thermodynamics, which states that entropy can never be reduced in a closed system. According to this law, entropy always increases. This means that the two rooms should always become more equal in temperature, never less equal.

The story has it that the link between information and entropy was "discovered" in this thought experiment. We can imagine a gate of zero mass that requires no energy to open and close, but the demon has to get *information* to decide whether to open the gate or leave it shut. The direction and velocity of a molecule can only be "seen" as a result of some physical interaction involving energy. There was no way to explain how the demon could get his information without expending some energy, so the conclusion was that the task was impossible, even for a demon.

## Schrödinger's Cat

Erwin Schrödinger first proposed this thought experiment in 1935. His cat is sealed into a box along with a mechanism. At one end of this mechanism are a source of radioactivity, a Geiger counter, and a timer. At the other end is a container of poison gas.

The radioactive source and the Geiger counter are connected in such a way that there is a 50% chance that a radioactive particle will be detected by the Geiger counter during a time interval. This will cause the poison gas to be released and kill the cat. The question is, if the cat is dead when we open the box, **when** did it die?

This seems like a stupid question, except that it has to do with the philosophical interpretations of quantum theory. The way quantum theory is formulated, it requires an observer to "make it work." It reminds one of the earlier question, "Does a tree falling in the forest make a sound, if nobody's around to hear it?"

According to quantum theory, certain quantum events have a dual nature until an observer steps in and "forces" them, by observation itself, into one or the other of two states. This principle is carried to the extreme with Schrödinger's cat. Some physicists maintain that until the box is opened and an observer looks into it, there are two parallel realities, one in which the cat is alive and the other in which it is dead. Others would say that the cat is neither dead nor alive in the interim. Now the question, "When did the cat die?" begins to take on an odd kind of sense.

According to quantum theory, it requires an act of observation to cause one of the possible realities to be chosen. A few very brilliant and quite serious men have even suggested that each quantum possibility generates a separate and parallel universe. All outcomes are realized, but each is contained in an endlessly growing number of parallel universes.

Personally, I find more satisfactory an explanation that quantum possibilities are translated into the macro world by the mechanisms that detect them, in this case by the Geiger counter, not by the human

observer opening the box. Physicists can define the macro world as distinct from the quantum world, but they seem to rely on intuition to define what an "observer" is. Earlier we dealt with the subjects of life, information, and observers. Surely, the cosmos, based on the operation of quantum mechanics, was not in limbo all those billions of years before a living observer had evolved. If so, is it in a different limbo for each observer that does evolve, or does it pop out of limbo when the **first** observer is evolved? This seems to get pretty ridiculous. Perhaps a better line of reasoning would go as follows.

Information is not involved in quantum "dual realities." Whether it's a tree falling in a forest or the detection of particle decay, observations have two aspects: One is the transfer of energy from event to event, and the other is the transformation of energy into information inside a living entity. There is every reason to believe that the universe runs quite well without us, that particles decay and trees fall. The significance these events gain with our observation is important only to ourselves. In effect, quantum mechanics needs to be defined **without** any recourse to an observer.

## Milgram's Experiment

In 1974, psychology professor Stanly Milgram asked the question: How much suffering can an authority induce an ordinary person working for them to inflict on an entirely innocent third party?

Roughly, his experimental protocol was as follows. There were three participants: The experimenter who was in charge, an actor who played the innocent third party, the "victim," and an "assistant" who was in reality the **subject** of the experiment.

The experimenter told the "assistant" some plausible story about testing for the effects of pain on the level of performance in some kind of memory task. The "assistant" was asked to administer an electric shock whenever the "victim" answered a question wrong. The shocks were to be increased by the "assistant" in steps of 15 volts up to a maximum of 450 volts. It was made clear to the "assistant" that voltages in the entire upper half of this scale were extremely painful and perhaps even life threatening to the "victim."

Groups of people selected from the same population as the "assistants" in this experiment were asked to guess how many people they thought would go all the way to 450 volts if requested to do so by the experimenter, but knowing that they were causing severe pain to another person. The consistent guess by these people was that 1 or 2 out of a hundred would go all the way.

A group of psychiatrists estimated that only one person in a thousand could be induced to go that far. Instead, what happens time and again in this experiment is that about two-thirds of the participants can be induced to go all the way. The people that can be led this far often perspire, plead to be allowed to stop, and even physically shake. But, they do what they are told.

Without the experimenter's orders to continue, "assistants" stop administering the shocks early on. If the request for the shocks to be administered comes from the "victim," they again stop at the first signs of visible pain. Even when the experimenter plays the victim and asks that the experiment continue, the "assistants" tend to stop. The paradigm most effective at getting people to continue is the one in which they are "following orders" and administering the shocks to a **third party**.

The clear and repeatable finding of this experiment is that over 60% of all people can be induced by an **authority** to do things well outside the limits of what they would normally do.

Other experiments have shown that this tendency also extends to behavior induced by peer pressure. People do what authorities tell them to do, even when it goes against their own judgement. People do what their peers do, even if they would do differently if not led by example. Notice the difference: People don't necessarily do what authorities do, and they don't necessarily follow what their peers command. We are led by the **commands** of authority and the **examples** of peers.

Often this is okay. These are the tendencies that evolve in social animals. These are *shortcut* behaviors. We will discuss shortcuts again later on.

## Turing's Test

Alan Turing, an early computer scientist who died in the 1950s, proposed a test to determine whether a computer could think. This test has evolved since Turing's first formulation of it, and the following version is somewhat simplified.

Suppose a skilled questioner were in a closed room and able to communicate via a keyboard and display with both another computer and with a human being. Over the course of a typed conversation, could the skilled questioner tell which conversation he was having with the computer and which with the human? If he couldn't be certain which was which, then the intelligence of the computer should be judged on a par with that of the human.

There is something unsatisfying about the Turing Test. It probably has to do with the fact that intelligence is so elusive and hard to define. For years *intelligence* has been "what intelligence tests measure." Intelligence does seem able to recognize intelligence, and the tests do seem to be repeatable, but there is probably much that is intelligent that the tests don't measure, and they don't correlate as well with many of the things (such as success in life) as we might like them to do.

When it comes to assessing intelligence in a machine, it's unlikely to be human-like intelligence. Perhaps we will know it when we see it (today, it's conspicuous by its absence!), but there is no reason to expect it to be just like our own. Therefore, the Turing Test is not a definitive test of machine intelligence.

It seems quite likely that machines will one day be intelligent, especially if we exert selective pressure in that direction long enough for it to evolve. When they are, instead of asking, "are they intelligent?" we might be asking, "are they **alive**?"

## The Prisoner's Dilemma

This scenario comes from game theory. In it, we have a classic two person confrontation where each person faces the same binary choice and gets rewarded or punished based on what both he and his opponent decide.

The scene is a prison cell. The prisoner's accomplice is out of both sight and hearing in another cell. The warden enters. He asks the prisoner to confess and, in exchange for leniency, help convict his accomplice. It is clear that the warden has already made the same offer to the accomplice, but he refuses to discuss the result.

The prisoner knows that if both he and his accomplice confess, they will both get light sentences. If neither confesses, they will both be set free. However, if one confesses and the other doesn't, then one will get a light sentence and the other will get a heavy sentence.

The prisoner's dilemma: If he confesses he will definitely serve time, but if he doesn't, he could either be set free or be in jail for a long time. One action leads to certain jail, the other leads to possible freedom or a long sentence depending on what the other person does.

Life is full of dilemmas like this. It pays to study how they arise and how they can be resolved. If you find yourself the prisoner of a one-shot dilemma, with no preparation for it, you have no choice but to gamble. You can play out a bunch of what-if chains of logic with yourself, but it comes down to how much can you afford to lose? If you had a fatal disease with only three months to live, you might decide to clam up, since that was your only chance to go free, any prison term being the same as "life." If you were young and simply wanted to avoid a maximum sentence, you might decide to confess.

However, you can plan for dilemmas such as this. If you and your accomplice had a pact, and you were both **trustworthy**, neither of you would confess and both of you would go free.

The terms "cooperation" and "defection" are commonly used to describe the choices in two person confrontations. Notice that cooperation means refusing to confess in the case of the prisoner's dilemma. You are cooperating with your accomplice, not the warden. If you confess, you are defecting. The warden simply represents one of the fixed aspects of the situation.

Many dilemma situations arise over and over. People have memories. If you defect this time, the other person will probably defect the next time. Studies and computer simulations have been done to prove that there is a simple strategy to handle confrontations that are likely to occur again, for which you haven't been able to prepare, and in which you have no idea how your opponent is likely to behave. This strategy is called *tit for tat*. It calls for cooperation on a first meeting with a given opponent and mimicking his previous behavior when you confront him again. This means if he "defected" the last time, you defect this time, but if he cooperated, then you cooperate. Over time, this pattern of response tends to "train" the other person toward mutual cooperation.

## The Paradox of the Commons

The scene is the village green (known as the commons and belonging equally to all the villagers). In it some sheep are grazing. All the villagers own sheep and it is entirely up to them whether to graze their sheep in the commons, or in their own yards. Of course, it costs a villager nothing to graze his sheep in the commons, and it does cost him something to graze them at home. Therefore, it is in each villager's personal interest to add his sheep to the common herd. Personal interests are served until the village green becomes so overgrazed that it can no longer support any sheep at all.

Does this remind you of a Prisoner's Dilemma? It should. The main difference is that it involves many people instead of just two. The solution to the paradox, again, is cooperation. Each person should get an equal share of the grazing rights. Governments are able to resolve different versions of this type of paradox. A democracy is a form of government that allows the people themselves to cooperate even when it goes against their individual self-interests.

## Prime Directives

Are you ready for your next set of instructions? Here they are: Develop a philosophy, morality, and code of conduct that enable you to live in peace with those who share your values, and in tolerance of those who do not.

Do not what the law allows, but what reason, justice, and humanity advise.

Choose the course that works best for **you**: Abstinence, or Temperance.

At the beginning of a cask, and at the end, take your fill; in the middle be sparing.

Strive to position yourself beneath envy, but above contempt.

Don't stand in your own light.

Keep big promises distant, small rewards frequent, and focus on the journey underway.

Strive to be "scientific." *Science* is important to an instruction manual on life for three reasons. First, science has evolved a methodology that is an important model to understand and pattern your thinking after. Second, science is useful. The more science you know, the more useful it can be to you. Finally, nothing refuted by science should be included in anyone's operating manual.

The next chapter makes this last statement more clear. Keep in mind that there is a big difference between what an individual scientist says and what "science" itself holds to be true. Also remember that science only relates to a small part of human reality. Notice that most of our reality is "consistent" with science by being **ignored** by science. Science may affect and be affected by religion, politics, and our daily affairs, but none of these is the **subject** of science.

Knowledge derives from how much and how well the intellect conforms to reality.

Nothing can possess a high degree of certainty that does not have a shred of evidence.

The difference between art and science is that the best art is created in private, the best science is done in public.

Science isn't the only thing you should pattern yourself after. It's not even the first thing, but it needs to be a part of your pattern if you wish to be a fully developed human being.

# II. The Methods of Science

*Science* is a quest for short, algorithmic compressions of everything we observe. This short definition, itself, is a good example of the term “compression.” Science seeks **compact** expressions in the hopes of satisfying *Occam’s razor*. This is the accepted rule that the simplest of competing explanations is the most preferred, and that explanations of the **unknown** should first be attempted in terms of the **known**. But, what about the rest of this definition? What does the word "algorithm" mean? Why is science a "quest"?

An *algorithm* is like a recipe; it’s a list of instructions for how to do something. In the sense used here, an algorithm could define a model, a theory, or a law. The quest of science is to build models in the form of algorithms: Models that describe and quantify reality to help us predict and deal with it.

A *quest* is a journey. A journey may be made with a particular goal in mind, or simply from some need that drives us forward. When a goal is clearly achievable, the “journey” is usually called a task. However, goals can also range from the difficult to the impossible. When a goal is judged by many to be impossible, it is often called a *holy grail*. This means that the goal is the solution to a Hard Problem (hard enough to defy man’s best efforts for a long time).

Science is a quest made out of need. It discovers new goals all the time. Many of its goals are holy grails. There is no **final goal**, or end in sight for science, because its new discoveries result in new goals. If its “final goal” were to have the most compact models for all available data, its goal still could not be reached.

Data can be gathered faster than it can be analyzed, so gathering and analysis can never end. Finally, there is no way to **prove** that you ever have the **shortest** algorithm, or most compact model for something, so we could never **know** it, if we did reach the goal.

If not, why is it so important to "do science?" The common answer is: "Science paves the way for technology, and technology paves the way for a higher quality of life."

Is this true? Have we really made any progress? Consider: The average caveman was considered old at the age of 19. The average city of a few centuries ago was much more polluted than most cities are today. As a species, we have left our footprints on the moon and practically the entire surface of our planet. We are taking larger strides, but with larger strides come bigger risks. Many (not all, nor even most!) of us enjoy a quality of life that is richer and more complex than **any** of our ancestors were able to enjoy.

A better reason for “doing science” might be that it’s an evolutionary process of discovery. It is **our way** of codifying information, just as DNA is nature’s way of codifying what it has achieved over the course of evolution. Science has only been at work for a couple of thousand years or so, but evolution has been at work codifying its "discoveries" for several billions of years.

Science is organized into branches. The most basic branch of science is mathematics. All other branches of science depend on mathematics, but mathematics only depends upon its own abstractions.

The next most basic branch of science, built on top of mathematics, is physics. Physics studies matter and energy, the primary aspects of existence.

Building on physics, with each branch of science complementing the others, the sciences of chemistry, biology, physiology, psychology, the social sciences were developed in turn. Each major branch of science includes several areas, some of which are branches in their own right. Astronomy, cosmology, and the study of elementary particles are all branches of physics. Computer science is virtually a branch of mathematics. Some disciplines, such as bio-chemistry, involve an interface between two sciences. Electronics grew in the interface between chemistry and physics. Artificial intelligence sprang from psychology and computer science.

What has become clear in the past hundred years is that science cannot easily and clearly be subdivided by subject matter. Nor is it possible to layer science with one branch resting on another. Each branch of science constantly grows and unfolds. When a new generation of scientists comes along, if an entire field of science cannot be embraced, the individuals must specialize. After at least one generation of scientists have been forced to specialize because a branch grew too large, each specialty has the tendency to become a whole new branch.

Virtually every branch of science has something to lend to every other branch. But, scientists have a nearly impossible task keeping up with their own field, never mind following the developments in another. So, cross fertilization becomes more difficult as the body of science grows. Because of the need for cross fertilization, branches of science may sometimes combine and reorganize, or individual scientists may sacrifice their understanding of a whole branch to become involved in several related branches. The days are long past when a single individual could understand all of science. Today it is important that individuals understand the **methods** of science. This is not true just for scientists, but for **all** individuals.

There is a body of data, concepts, and ideas that are continually subjected to confirmation or disproof by the scientific community. The body of science is like an ecosystem with many different entities. Currently accepted ideas are the “living units” that comprise science. The transmission of these ideas to the next generation of scientists is the essence of its copying process.

While the body of accepted “science” may seem quite cut and dried to an outsider, the actual practice is full of all the dynamics of any human endeavor. Scientists may reach a consensus on some issues and not on others. A consensus is sometimes overturned. Scientists and non-scientists alike should be very aware of which issues have how much consensus and how long the consensus has been in place. Issues with a marginal consensus, or issues that have been “decided” for less than a couple of generations, are issues that we should be very careful of injecting into political or social decisions. A strong measure of conservatism should be called for in such cases.

There are many examples in history of science being the “tail that wags the dog.” Two examples, in fact, are ongoing. One is the prediction of global warming, the other is cold fusion. Either of these could turn out to be “true.” The evidence is not complete. And yet, both of these have shaken up society at large.

Perhaps twenty years ago, scientists were telling us that the earth’s climate was getting cooler. This didn’t cause much loss of sleep, because we know how to deal with harsh winters, more snow would mean better skiing, and maybe some of the uncomfortable hot climates would become easier to live in. Then, they said “whoops!” there’s a greenhouse effect taking place. The earth is warming up, not cooling down. Now, there’s cause for alarm. Not only are we in for some bad years of skiing, but if the

polar ice caps melt, all of our valuable coastal real estate could be lost. Now, here's a prediction worth losing sleep over. Here's a situation worth big funding dollars.

For more than thirty years, scientists have been promising us cheap power from nuclear fusion. We've been patiently waiting. Then, one day it appeared that this holy grail had finally been reached. Cold fusion required little in expensive equipment and promised cheap power very soon. But, again they said "whoops!" And, sources of funding turned on and off so fast that the monetary pipes rattled.

Later, we will see some more examples of science interacting badly with government, but this tendency can't be stopped until more people, especially politicians, understand how science is supposed to work. The best science is done in **public**, not private, and this means that the public needs to understand the **methods** of science.

## The Scientific Method

*Science* (here is a second definition to complement the one given above) is a body of knowledge accepted by the scientific community as being self-consistent and derived from repeatable observations and experiments. It consists of models, procedures, and anecdotal descriptions all couched in language or special notation that is more precisely defined than everyday language. Science needs to be somewhat resistant to change. This is accomplished by virtue of its robust procedures. One observation by an individual scientist makes no immediate difference. When this observation is communicated to the community it may cause a tremor. But science, itself, remains essentially unchanged unless the observation is **repeated** by other scientists, **disconfirms** some aspect of the current model, and is accompanied by a **new model** that adequately handles or subsumes past observations and models. The *scientific method* is way science evolves.

Data are transformed into models in the following six-step process.

1. Observation: Something observed isn't predicted by the current model.
2. Deduction: A reasoning process or leap of imagination is used to connect the data into a pattern, model, or explanation.
3. Hypothesis: A prediction is made based on the deduction.
4. Experiment: A carefully controlled procedure is performed to test the hypothesis.
5. Conclusion: A statement of the new model or theory is made in terms that are falsifiable. A theory or belief that can't be tested and possibly proven false is not useful to science.
6. Verification: The whole sequence is repeated, preferably by another scientist who must be able to follow the logic of the original observation, deduction, and hypothesis, then repeat the experiment and come to the same conclusions.

A mathematical statement that conforms to the syntax and grammar of math may be true or false. The truth of such a statement depends upon a proof which reduces the statement to the support or contradiction of mathematical axioms. If the axioms can be shown to lead to the statement, then it is true. If the statement, on the other hand, can be shown to contradict the axioms, it is false. It is not always easy, nor even possible, to prove either possibility.

Gödel's Incompleteness Theorem states:

> In any system, there will always exist more true statements than statements which can be proven true.

For us, this means that, with respect to any given statement, we may find out whether it is true or false, but no method for doing so exists which will work for all statements. Finding the truth, and exposing the lies turns out to be a difficult and often thankless task. Truth rests upon a foundation of proof and the assumptions made by the proof. Both the assumptions and the proof may be nearly impossible to develop. Either the proof or the system within which it is developed may later turn out to be faulty.

In other systems a proof may be less straightforward to construct. In systems that are supposed to model some reality, the science of physics and the physical world for example, a statement could lead to a contradiction of the basic model. This could mean that the basic model is at fault. When our system doesn't predict things that we can observe in the laboratory, it is time to modify our assumptions. When it predicts things that we can't observe in the laboratory we continue looking until we find them, or until a better model is developed.

Observations which lead to a contradiction of the current model are sometimes harder on the observer than the model. Scientists have been known to lose their careers in the process, but in the long run the model is usually modified to reflect a gain in knowledge. Some systems (especially social, religious, and moral systems) receive such constant buffeting and confrontation that they are much better designed to resist them. These are systems that can slow progress very effectively. On the other hand, systems that change too easily may be rather short lived.

## Parsimony

Science tries to build models of nature that are economical. This is in keeping with the philosophy of William of Ockham (of Occam's razor fame. Yes, it **is** ironic that we need two different ways to spell his name!) Good, economical models follow the principle of *parsimony*. When our model of the atom required only the electron, proton, neutron, and photon, it had parsimony. Now, the theory of Quantum Electrodynamics requires many dozens of sub-atomic particles to explain it. Some scientists feel that QED can't be correct, if only because it is so lacking in parsimony.

Of course, a thousand years ago, scientists believed in only four elements: Earth, air, fire, and water. Now science has grown comfortable with 92 natural elements and several artificial ones.

Mathematics is a language for describing the universe, and in some ways it is a mirror of nature. In mathematics, clear axioms can be laid down and statements may be proved or disproved in clear proofs based on them. In science, we never assume that our models are the "axioms" of the universe. But we do consider it support for a model when statements, whose truth can be proved from the model, can be confirmed by observation. A statement is considered proved if it follows from a model or set of axioms. It is considered disproved if a counter-example can be found, or if its opposite can be proved.

It seems consistent with experience that the real world does not always follow our desire for parsimony. But, if we can show that even mathematics doesn't always follow this principle, perhaps it will be easier to accept this disappointing truth. The following two examples bear out the fact that this is indeed the case.

The four-color problem was stated hundreds of years ago, but no one had proved it until 1976. The statement of it is simple: "Four colors are sufficient to color any map drawn on a plane surface so that each contiguous region is colored differently from all its neighbors (those that border it by more than a

point)." Map makers have known that four colors were sufficient for hundreds of years, but no one had ever proved this to be true.

The proof was found in 1976 by Haken and Appel. It required a computer and many pages of printout. It was far from a parsimonious result. Statements, whether they are about natural phenomena or mathematical constructs, are supposed to be either true or false. But, instead, they can be ambiguous, fuzzy, or irrelevant. They can imply a mistaken assumption or model. They can be self referential. Even if they are well phrased, they still may not be **provably** true or false in any small, or even finite, number of steps.

Goldbach's conjecture is the mathematical statement, "Every even number is the sum of two prime numbers." This statement appears to be true, but unprovable. If someone ever found an even number that was not the sum of two primes, it would prove the statement false, but no one ever has. And yet, as before 1976 with the four-color problem, no one has any idea how to prove the truth of this apparently simple statement.

Unprovable statements arise when what appears to be a single problem breaks down into an infinite number of different problems. For example, Goldbach's conjecture makes a statement about all the even numbers. There are an infinite number of even numbers. Each one of them poses a unique problem in terms of finding two prime numbers that add up to it. Thus, at present, it appears that Goldbach's conjecture breaks down into an infinite number of problems.

To prove his conjecture true, someone would have to discover a finite number of procedures such that every even number corresponds to a procedure that determines the two prime numbers adding up to it. Thus, each procedure would handle an infinite subset of the infinite set of even numbers. It seems unlikely, at present, that this will ever be done, but who knows? In any event, this is an example of the kinds of problems that mathematics and science can encounter and why some seemingly simple conjectures may be true, but remain unproven forever.

The four-color problem turned out to be one of those problems, not often noticed in the past, but perhaps more typical of what the future could bring. Problems that break down into a very large number of separate problems. The trick is to spot the patterns so that they can be enumerated and spelled out in detail. Haken and Appel's insight was that the Four Color problem did not pose an infinite number of separate problems, just a very large number of them. Such a large number that only a computer could solve them all. But, even a computer can't solve an infinite number of problems, and that is a difficult distinction to make. How long do you let the computer run before you give up?

The notion of parsimony is therefore, at best, a *heuristic* for doing science. When different assumptions fit the observations, how do you choose? Choose on the basis of which assumptions form a better foundation to build on. When it becomes too difficult to compare the structure you **could** build, to the well constructed, baroque but familiar, cathedral you already have, fall back on the heuristics of parsimony, economy, and elegance.

## Chaos

Science has always been an attempt to find order in nature. It has traditionally been founded on the hope that the world is rational in all of its observable aspects. Branches of science that have had to resort to statistics were called "soft" sciences at one point, as opposed to those founded on more rigorous mathematics.

In the mid-1800s the concept of entropy was introduced as part of the science of thermodynamics. Thermodynamics is the study of how heat relates to other forms of energy. Early in this century the science of quantum mechanics was developed. Quantum mechanics is the study of the structure and behavior of atoms, molecules, and their interactions with small quantities (or quanta) of energy. These sciences involve systems that, at present, are described by statistics. This fundamental unpredictability seemed wrong to many scientists. Einstein called it "playing dice," and he refused to believe that God would permit such a universe.

Lately, a concept called "*chaos*" has captured the essence of this side of nature. The measure of chaos in a system is the system's sensitivity to initial conditions. A perfectly "orderly" system is one in which the amount of error in measuring the initial conditions is proportional to the amount of error in the final prediction. For example, we can predict very closely where a missile will land. The more accurately we are given its initial velocity, the speed and direction of the wind, and its wind resistance, the more accurately we can predict where it will land. It was once thought that all systems were of this type.

Then scientists tried to predict the weather. Weather models were first suggested around the turn of the last century. Only with the advent of the computer did they become practical. However, even today's weather models are useless beyond about five days. They are so sensitive to initial conditions that, in principle, a butterfly in my back yard today can disturb the air enough to influence next month's weather in Russia. The more data we have, and the more accurate it is, the longer a computer needs to do the calculations. As we increase the amount of data and the computer power, so that the time and accuracy increase between prediction and event, we find expenses going to infinity, and further gains going to zero.

It turns out that chaotic systems (an apparent oxymoron) do have patterns and regularities. These systems may be unpredictable, but within them are things called "strange attractors." Think of a smooth metal surface with very slight hills and valleys. Imagine trying to roll a steel ball into one of the valleys. The valleys are strange attractors and the initial conditions are the speed and direction you impart to the ball. A very tiny difference may cause the ball to end up in a different valley. But, you do know that it will end up in one of the valleys. So, if you can get a topographic map of the system, you will know a great deal about it.

A hurricane is one of these strange attractors in a weather model. An electron probability cloud is one within the QED model. Chaotic models can be tackled with concepts from statistics, topology, and other branches of mathematics. Many of these concepts have been around for years, just waiting for "chaos" to make them more useful.

## Information Theory and Epistemology

*Information theory* is the study of message transmission over noisy channels. *Epistemology* is a branch of philosophy that studies knowledge itself, its nature and origin. Both of these concepts, information and knowledge, are central to an understanding of life, and any instructions that may be given on the subject. Therefore, of all the scientific disciplines, these are definitely ones that need to be covered here.

The fields of computer science and artificial intelligence have benefitted much from the mathematics of information theory. We have advanced rapidly in the technology that enables us to build better computers and transmit more kinds of messages more accurately over more kinds of channels. But these fields have been slow in explaining intelligence and the workings of our own brain.

Two technologies that relate more closely to the brain, that have also come from computer science, are Expert Systems and Neural Nets. Both of these deal with the storage and use of knowledge. Expert Systems are collections of rules that are derived from the knowledge base of an "expert." When these rules are coded into computers, they make an expert's knowledge available for less than it would cost to employ more experts. Neural nets are patterned very roughly after the design of our own brains. Later, we will seek insight from these two subjects, but first, let's briefly explore a few of the more basic topics of computer science.

Scientists have barely begun to learn how energy is transformed into information, and how information leads to knowledge and wisdom. We need to know more about how knowledge can be stored, transmitted, and used. Epistemology needs to become an actual science. However, this ambitious project lies beyond the scope of a single book. For now, let's begin with a short introduction to information theory.

## Information Theory

Claude Shannon pioneered this field in the 1940s. He was interested in the transmission of messages over noisy channels. He measured the content of messages in units of *bits* (binary digits). Each bit is capable of answering a yes/no question. This gives us a way to measure, or quantify, a message. But, information theory says nothing about the **content** of a message. It does not address the questions, themselves, to which each bit is a yes/no answer about the message. It does, however, prove or make explicit a number of other important concepts that are worth knowing about.

Any *message* **can** be encoded into a linear sequence of bits; the bits **can** be transmitted over any *channel* with a non-zero capacity; and the bits **can** be decoded accurately into the original message. A channel's capacity may be given as the number of bits per second that can be transmitted accurately over it. Most of information theory deals with the characteristics of channels: How much noise they have, and how uniform the noise is. Channels may be a band of radio frequencies, a wire, a glass fiber, or the magnetic surface of a tape or computer disk.

Just as there are many different types of channels, there are many different types of transmission or recording techniques. They fall into two major classes: *digital* and *analog*. Morse code and early telegraphs were an example of digital transmission. Currently, radio and television are examples of analog. Analog transmission skips coding the message as a sequence of bits. It uses a model or image (an analog) of the message. For example, the sound waves of speech are transduced into radio frequencies that are modulated just like their sound counterparts, and then back again into sound waves many miles away by a radio receiver. The disadvantage of analog transmission is that it's fairly sensitive to noise.

When noise corrupts the message being transmitted, information theory gives us a way around it: redundancy. More *bandwidth* (a larger range of frequencies) or channel capacity can be used to transmit the message and guarantee its accurate arrival. As an example of how this theory translates into technology, let's examine two types of encoding as applied to radio transmission. The first technique used for the analog transmission of early radio was AM (amplitude modulation). A single frequency called the carrier wave was used for each radio station. These frequencies didn't have to be very far apart for the electronics of early radios to separate them, so it was an efficient use of the available frequencies. But, with little bandwidth came the vulnerability to noise. Every bit of noise that is added to the transmitted amplitude of the carrier frequency directly affects the signal received.

A second method of encoding radio signals, called FM (frequency modulation), was invented. As more of the frequency spectrum became available through advances in technology, a range of frequencies (more bandwidth) was used to transmit the signals. Instead of transducing sound frequencies into variations of total energy (amplitude) of a single frequency, FM varies the frequency of the carrier wave. The more variation, the louder the sound transduced. This technique is more immune to noise because it uses more channel capacity. Random noise has little effect unless it overwhelms the carrier frequency. Of course, radio energy at or near the carrier frequency does have a considerable effect. But, nature is seldom the cause of this, and government agencies regulate the airwaves to minimize man's effect.

Digital information, a string of zeros and ones, can be transmitted with either AM or FM. In AM, a zero might be a cycle of vibration with a very small amplitude, and a one might be a cycle with a large amplitude. Any source of noise added to this signal, of course, would turn some zeros into ones and vice versa. It's easy to see that AM is not very immune to noise, so digital information is usually transmitted by FM.

Both techniques permit another way to enlarge the channel capacity. We can take more time. We can let each zero and one be more cycles of the carrier frequency, or we can transmit redundancy bits. We can even transmit the entire message several times. Another way to take more time is to squeeze each bit into a single cycle of the carrier frequency and add a few bits every so often so that errors can be detected. If an error is detected, the offending block of data is retransmitted on the receiver's request.

Information theory doesn't address the content or meaning of a message, or how it should be encoded into a string of binary digits. It measures information strictly in terms of the number and rate of bits transmitted, attention is paid to the kinds of redundancy necessary to ensure that errors can be detected, and ways to correct errors in the face of different kinds of noisy channels.

The pace of advancements in electronics has been almost entirely due to putting information theory to work. New, bigger, and better channels have been developed. Better recording and transmission technology has evolved. Techniques for noise suppression, error detection, and error correction have been invented. Among other things, this has given us better devices for sound and video, more and better telephones, and faster, cheaper, and smaller computers.

## Language and Communication

Communication and language are also key concepts to epistemology. Language is a **system** of symbols used to record information. We will explore the concept of *language*, as an evolving entity that can record and convey information, several times in this book. These themes (language, evolution, and information) are very important to an understanding of life—and they are worth exploring in detail.

The concept of language is the first step in understanding the **messages** of information theory. Communication is a **process** that takes information through four states. In the first state, information exists in the form of a pattern, an idea in someone's brain perhaps. Next, this pattern is encoded into a symbol or a group of symbols such as words. Then these symbols are transmitted and received. And, finally they are decoded and something like the original idea or pattern is constructed.

The steps of encoding, transmission, and decoding may take place several times. For example, take two people talking over the telephone. No one knows what the original pattern of an idea in the brain looks like, but somehow it gets translated or encoded into nerve impulses. These get translated into

muscle movements that control the lungs, the mouth, the tongue, and the larynx. The effect of these parts working together is modulated sound. Next, sound is translated into electrical energy in the telephone mouthpiece. Before it reaches the earpiece of the receiver, it has probably been encoded and decoded several times, perhaps over glass fibers, microwave towers, and communication satellites. The final result of communication may be something less than perfect. Information can be lost or mutated in this chain of events due to inaccuracies in encoding or decoding, or by the effects of noise.

The encoding, transmission, and decoding process of communication is very similar to the **copying process** of evolution. The process of communication is inherently subject to many of the same factors that drive evolution itself. It might even be that communication is a special case of a family of copying processes all of which support evolution of different types.

A *language* is a system in which "statements" can be made. There are all kinds of such systems and many have more than one language associated with them. The natural or spoken languages are examples of languages which are capable of making statements relevant to the interwoven systems we call human culture. Art forms are subsystems of culture, and art consists of statements made within the system of an art form. Molecules of DNA are statements in a chemical language that are relevant to life at a biological level. And there are computer languages used by man so that a computer can follow the directions he gives it. For our purposes, it will be sufficient to state that anything used to store or transmit information is being used as a language.

Thus a language may even exist without any human recognition of the fact. However, when we do take note of a language and attempt to describe the framework or system within which it operates, we will find ourselves making statements about the language itself.

A complete language is described by an alphabet, vocabulary, and a grammar. The notation used to write the definition of a grammar is actually a language in its own right. A language that describes another language is called a *metalanguage*. The metalanguage of English, for example, includes such words as "noun" and "verb" and things like how to pronounce the A-B-Cs.

A metalanguage is not necessary to the existence of a language, nor is its existence implied by the existence of a language. However, to make statements <u>about</u> a language, not simply <u>in</u> a language, we must make them in an artificial language, invented for that purpose, perhaps after much trial and effort. A metalanguage, and the statements recorded in it, reflect the extent to which a language is understood. The distinction between language and metalanguage is sometimes blurred. For example, in English, the metalanguage has simply been added to English. A counter-example, however, might be made of almost any non-spoken language, ones which occur in nature or perhaps art. Art is usually described in a special vocabulary (and in a spoken language); it would be very interesting to use an art form as a metalanguage to describe another art form.

A painting is an artistic statement. Poems and novels are literary statements. People's selection and wearing of certain clothes are fashion statements.

Statements need not involve consciousness. An ant makes a statement when it gives off certain chemicals which other ants interpret as identification. Bees make statements with their dances, indicating to other bees where a new source of nectar may be found. Likewise, from the simplest animal to the most complex, statements of one form or another are constantly being made to and received from different parts of their environments.

We have seen that languages can take the form of widely divergent systems and we have developed a working definition of language. Any system in which a statement can be made to hold or transmit some form of intelligence is a language. In order that they might unlock the secrets of DNA, scientists designed a metalanguage to describe the language of DNA. This language has an alphabet made up of four letters (represented by four different molecules). The rules by which these molecules can be combined to form statements, and what these statements mean, are being studied; and many have already been found out.

The evolution of life on earth has recorded all of its results, all of its "knowledge," in the form of a language written in DNA. Man has developed hundreds of spoken languages and has written millions of volumes in many dozens of these "natural" (spoken) languages. In addition to spoken languages, he has invented systems of notation to describe scientific and technical knowledge of many different types. No one knows how many systems of notation have been invented. Many have died out. But, they have consisted of the notational systems of today's stockbrokers on Wall Street all the way back to those of the ancient astrologers of Egypt.

Natural languages evolve in the course of generations of cultures speaking them. Artificial languages, metalanguages, and notation are invented to describe systems. The maturity of these languages and the information we have recorded in them reflect our knowledge about the systems we have attempted to describe.

The most precise system we have for recording and communicating information (since we made it up to be exactly that) is our system of mathematics. In math we can solve problems, and make statements. The metalanguage for math is also well developed. At its basis are statements which tell us what the mathematical symbols are and how we may arrange them. It explains what the various constructions and symbols are understood to mean. It states the axioms, which are assumed to be true, and describes the methods that may be used to prove any given mathematical statement true or false.

Now that we have a general concept of the term "language" namely a system which can be used to store or transmit information in the form of statements, let us note some of the common properties of languages. Some of these, which we may also note in the English language, are:

1. A character set, giving the basic units of the language, units generally below the threshold of "meaning."
2. Words, assemblies of characters into the smallest "meaningful units." To understand this, simply generalize from what we mean by a word in English to molecules in chemistry, chords in music, etc.
3. Statements, the smallest unit which is allowed under the complete rules of the language's grammar. This usually turns out to be context dependent, usage dependent, etc.

The meaning of statements usually changes over time and place more greatly than that of words. And words change more readily than do the characters. If we begin with the character set, we might propose to combine them to form words at random. But we know that not all such "words" will be allowed. A set of rules (derived from usage, natural law, or whatever) causes a subset of the possible constructions to be selected.

"Bristogriph" is not an English word, though it might sound like a newfangled invention or perhaps a legendary animal. If we are in doubt, the dictionary of English usage settles the matter. A student of chemistry might guess that there is no such "word" as krypton oxide, because the rules of chemistry

imply that krypton will not combine with oxygen. If this substance were actually discovered, it would be time to update our understanding of the rules.

Once we have defined a set of words, we can begin to study how they are combined. Again, we find certain combinations are not permitted and certain ones are. The system of rules that tells us how we may or may not connect words into larger formulations (statements) is the grammar of a language.

A statement may be classified by its purpose or its participation in a surrounding process. In English we might say that the purpose of a statement is to: Ask a question, give a command, or state a fact.

Perhaps we could generalize and say that in any language a statement has one (or a mixture) of three purposes: 1) To generate feedback, 2) To cause an effect, 3) To simply broadcast or record information.

Statements made in a natural language (spoken or written as a part of human culture) may relate to one or more of the following human endeavors: 1) Art, 2) History, 3) Theory, 4) Procedure.

An artistic statement expresses feeling, fantasy, or sensation. History is a record of the past. Theories are in a sense predictions, they are expressions concerning a given set of conditions and an expected outcome. Procedures are directions for getting something done. A procedure is based on the performance of certain operations, depends upon the assembly of certain initial conditions (raw materials, perhaps), and explains how to do or make something.

Each of these areas constitutes knowledge. The basic forms of a statement (question, command, and factual) have their purposes in relation to the discovery and use of knowledge. More basic yet, they play roles in connecting and lubricating the cogwheels of human culture. People may feel things; it becomes art when they attempt to communicate them. People come to an understanding of things; it becomes theory when formulated as a statement or model in spoken language or notation. Finally, there is the huge repertoire of recipes and procedures that are recorded in some fashion and passed on from one generation to the next.

People may hold a belief and act on it, but it is not a theory until it is stated and can be subjected to attempts of proof or disproof. Finally, something can certainly be done or achieved without anyone knowing how exactly. A procedure states a method to do it in terms of what is necessary to begin with and what step-by-step operations must be performed. A procedure may be recorded in some fashion, or it may simply be communicated in the language of example, reposing first in the teacher, then in the learner.

As we have noted before, statements of any type, question, command, or information may be well-formed and consistent with generally accepted truth, or they may deviate from this in a variety of ways. Questions may have unacceptable implications or conditions attached to them. Commands may also be unclear or unacceptable. And we have seen that even normal statements may be true, false, and otherwise. Even true statements may range from the tautological and vacuous to the unprovable. Ultimately, the value of a statement depends upon its usefulness, but this test usually comes later. First, it must be received, understood, and measured against the knowledge we already have.

Our culture consists of these three things: Feelings and sensations transmitted through our art, factual knowledge recorded as theories (or claims, taking a much less rigorous form), and skills propagated by procedures. These, our art, science, and technology, represent the achievements of man, the accumulation of our creative efforts of design and expression.

These three categories, art, theories, and procedures, are simply artificial distinctions. They are intended to reflect the three traditional aspects of the nature of man: Spiritual, Intellectual, and Physical. These aspects were noted in some of man's earliest observations of himself and they have persisted as a complete set to this day. Whether by accident or necessity, it seems to be the case that the records we make, our observations about the universe, fall into these three categories. Art is our attempt to record, describe, and communicate the spiritual. Theories result from our intellectual observations and conclusions. And procedures are the abstract synthesis of our physical achievements.

Statements may be made simply to "stroke" other people, to make them feel something, know something, or do something. Our art is what we are. Our theories are what we know. Procedures define what we can do. All of this is adds up to our culture. History is our record of it, recorded in speech and writing.

Now that we have an idea of how language is used, the things it can record and communicate, let's look at language more technically.

## Language Theory

Language **theory** deals with structure and translation, it does not address information content, semantics, or the purposes to which messages may be put. In the present state of the art, these are treated as special cases. Technologies based on language theory generally involve computers and special software. This software is used to translate computer programming languages into the machine codes that actually run computers, or it may be used to encode and decode messages for transmission. It can be used to interpret and follow instructions given in special languages, such as the popular HTML for directing internet browsers. Another example is the software "inference engine" used to drive an Expert System.

The problems of voice recognition, speech production, and language translation (from one spoken language to another) have been worked on for about forty years. By a combination of brute force and much thought, slow progress has been made. These are the "hard" problems being tackled by the technology spawned from language theory. We still have far to go.

One of the major figures in language theory is Noam Chomsky. He defined four classes of languages by the types of restrictions one could place on the rules used to define a language. As mentioned earlier, a language can be defined by an alphabet and a set of rules.

An alphabet is a list of the smallest permissible units in the language. An alphabet could consist of just zero and one, or the 26 letters of the Roman alphabet, or all the characters used to write one of the Oriental languages. Standards exist for mapping all the alphabets of the world's natural languages into bit sequences (32 zeros and ones are used for each character in one of the standards). In another standard (ASCII) the upper and lower case Roman alphabet, the digits 0 to 9, and certain punctuation and other characters are mapped into a 7-bit code. The smallest code was a 5-bit code, used by the U. S. Army for about 30 years. There are also 8- and 16-bit codes.

The rules that define a language are called *productions*. Production rules define how the characters of an alphabet may be arranged into permissible statements. A complete set of production rules is called a *grammar*, and is, of course, written in a *metalanguage*.

When a formal language is defined, each production rule takes the form of Left-side produces Right-side. Either side of the rule may contain letters of the alphabet and variables that refer to other rules. A

sequence of letters or characters from the alphabet and/or variable symbols is called a *string*. A string is just a sequence of characters or symbols whose order and content are both important.

The rules of a grammar may be used to **produce** a valid statement in the language, or to **recognize** a valid statement that may already exist. A valid statement contains only letters of the alphabet, it contains none of the variable symbols used to "connect" the grammar.

Let's see how this looks in a simple example. Here our notation (metalanguage) will use the symbol → to mean "produces" between the Left-side and Right-side of a production. Variable symbols will be printed in boldface and the alphabet will consist of the normal lowercase letters and be printed in normal type. Here is a short grammar.

1. **start → sentence**
2. **sentence → statement** .
3. **sentence → question** ?
4. **statement → subject verb object**
5. **question → verb subject object**
6. **verb** → is
7. **subject** → he
8. **object** → home

From this grammar we can recognize or produce the two sentences "is he home?" and "he is home." It seems like a lot of trouble just to define two sentences, but complexity can mount up fast in a grammar. On the other hand, a grammar to define English in this way has never been written (although projects are underway). It would have a lot of rules, many thousands.

Let's make a few observations from this example. First, notice the variables in boldface. Each place the word **verb** is used, the word **persiflage** could just as well have been used. There is no meaning associated with the spelling of a variable in the grammar, they are simply used to connect one place to another. A variable on the Right-side of a production is a reference to some other rule, called a definition, where the same variable appears on the Left-side.

Notice that there are two rules whose Left-side is the variable **sentence**. This means there are two definitions of **sentence**; we can choose either one. Notice the period and question mark. They could have been placed at the end of rules 4 and 5, instead of 2 and 3. There is usually more than one way to define a grammar.

In language theory, the "meaning" of a statement is simply the sequence of particular rules that are substituted to produce or recognize the statement. All valid grammars contain a set of rules that have a single variable symbol, called the Start symbol, on the Left-side. This indicates that the rule is a "start rule." They also contain a set of rules that contain no variable symbols on the Right-side. These are "terminal rules" of the grammar.

All rules with a variable on the Right-side cause an "intermediate string" to be produced. The following example begins with **start** as its initial intermediate string. The next step is always to find a rule whose Left-side matches part or all of the intermediate string. The Right-side of this new rule is then substituted for the matched part of the intermediate string, and a new intermediate string is produced.

This is done until no variable symbols remain in the intermediate string. At this point a statement has been produced.

Here is the sequence of intermediate strings that would correspond to producing the sentence “is he home?” from the above example.

**start**

**sentence**

**question** ?

**verb subject object** ?

is **subject object** ?

is he **object** ?

is he home?

If an intermediate string contains variable symbols that do not match the left side of any production rule, the process also has to stop, but this signifies an error in the grammar, or an ambiguous grammar coupled with the wrong choice of a rule somewhere in the production process.

Recognition is the reverse of production. The Right-sides of rules are matched to the initial statement or intermediate string, and the corresponding Left-sides are substituted until the intermediate string consists only of the Start symbol. The sequence of rules used to recognize “is he home?” is simply the above list in reverse order (bottom to top).

If two or more **different** sequences of rules can produce the same statement, the grammar is said to be *ambiguous*. If two or more symbols appear on the left hand side of any production, the grammar is said to be *context sensitive*. Although Language **theory** has little to say about how meaning is associated with the use of a production rule, the **technologies** that actually use language theory generally connect an action (carried out by a computer) with the use of each rule.

The languages identified by Chomsky ranged from natural languages (called Type 0) to regular languages (called Type 3). A natural language has no restrictions on the types of symbols that can be used on the left and right sides of its production rules. Type 1, Type 2, and Type 3 languages put successively more restrictions on the types of production rules they allow.

A Type 1 grammar is called “context sensitive.” Its production rules are limited by requiring both sides of the rule to begin and end with the same context. The Left-side must contain exactly one variable symbol in addition to any context symbols that might be present. The Right-side counterpart to this symbol may be any string of symbols, including an empty string. Since the context symbols, zero or more, are the symbols that begin and end **both** the Left- and Right-side of each production rule, substitution leaves the context part unchanged.

A Type 2 grammar is called “context free.” Its rules are further restricted. The context part is not allowed and the right side must contain at least one symbol. Therefore, the left side of each rule contains a single variable symbol, and the right side contains any sequence of one or more symbols.

A Type 3 grammar is called “regular.” Its rules add a further two restrictions to those for a Type 2 grammar. First, the right side must include one or more symbols from the alphabet. Second, the right

side may include at most one variable symbol, and that symbol (if present) must be the last symbol in the rule.

Many other permutations and combinations of rule restrictions are possible. In fact, language technology has centered its work mainly on context free and regular languages, with minor restrictions or extensions. For example, a common extension to the normal context free language is made by lifting the restriction that the right side of each rule must contain at least one symbol. Instead, it may be allowed to have no symbols. Another common variation is that a regular grammar might be allowed to have its variable symbol be the first, instead of the last, symbol on the right side.

This formal theory of languages grew up alongside computers. It was natural that the question be asked, "What kind of machine does it take to handle each of the types of language?" The answer to this question involves a theory of automata, a theory that parallels language theory.

## Automata Theory

*Automata* Theory is the study of computability. Its subject matter ranges from Gödel's Incompleteness Theorem to the theorems of Post, Church, and Turing. This brief introduction will be limited to the discussion of a few abstract machines in order to make some sense of what a computer is. Most people reading this will have already encountered a computer, but not everyone knows their capabilities and limitations. In fact, no one does! We are still discovering new uses and designing new software for computers.

The simplest abstract machine, or theoretical automaton, is a Finite State Machine, or FSM. It gets its name from the fact that it can only be in a finite number (occasionally a very large number) of states. Most simple mechanisms can be modeled by a Finite State Machine, and the concept makes designing machines easier. An FSM has a limited number of things it can do. It can recognize a set of inputs, and it can change states based on its current state and input. Its behavior is completely determined by its program. It has no memory or behavior other than that determined by its current state and next input.

Here is an example of a very simple FSM. We will let it recognize two inputs: Zero and One. We will give it three states: A, B, and C. The two possible inputs, times the three states it can be in, defines a 2 x 3 program. Our machine will start in state A. The program for that state is: given an input of One, change to state B; given an input of Zero, remain in state A. The program for each state has to cover all possible inputs and what state to go into next. State B is: given an input of One, change to state C; given an input of Zero, go back to state A. State C is: given an input of One, halt; given an input of Zero, go back to state A. This machine is now designed to recognize three consecutive Ones and halt. Each time it sees a Zero, it starts over.

A typical machine has exactly one start state and at least one halt state. Machines begin to receive input in the start state, and some action is taken when they reach a halt state. Different actions may result from different halt states. A well designed machine will handle any sequence of input, even though some of its halt states may signal an input error. Once a halt state is reached, machines might ignore further input until they are reset to their start state again.

Let's see how a vending machine might be modeled by an FSM. Input will come in the form of a sequence of coins and button pushes. The halt states will correspond to vending a selected item and returning change. Based on a sales price of 50 cents, the machine will handle any amount of coins

greater than or equal to 50 cents. A button press with less than 50 cents on deposit will be ignored. If more than 50 cents is on deposit when the selection button is pressed, change will be returned.

States necessary to represent up to 10 nickels, 5 dimes, and two quarters will be required. Amounts over 50 cents that might occur are, 55 cents (nine nickels and a dime, one quarter and three dimes, etc.), 60, 65, and 70 cents (with various combinations of coins). Some combinations of these, and any amount of 75 cents or more, can be disposed of simply by refusing the coin (letting it drop through the coin return). Thus, certain states will be hooked up to the coin accept mechanism, as must be the coin recognition hardware.

A program for this machine, given four selection buttons, needs a table seven high (for its inputs), and fifteen wide (to represent all the amounts of money it has to remember, zero to seventy cents in increments of a nickel). Given a coin input and state less than 50 cents, it advances to a higher state representing the total amount input. Given a selection button, and a state less than 50 cents, it remains in the same state (and does nothing). Given a coin input and a state of 50 cents or more, it remains in the same state (and returns the coin). Given a selection button and a state equal to 50 cents, it halts (and vends the selection). Given a selection button and a state greater than 50 cents, it halts (and vends the selection, and returns 5, 10, 15, or 20 cents change).

There is a correspondence between what different automata can do or compute, and the complexity of what the different Chomsky languages can express. The set of inputs to an automaton, or symbols that can be recognized or recorded by it, are equivalent to the alphabet of a language. The productions of a grammar correspond to the program of an automaton. The current state of the automaton is equivalent to the intermediate strings generated in producing or recognizing a statement, and the actions, including changing states correspond to the substitutions of rules. This may not be perfectly obvious in so short an explanation, but don't worry about it. If it piques your curiosity, you might want to doodle with some of these ideas using pencil and paper. If it really intrigues you, a course in computer science might be the answer.

A Finite State Machine can produce or recognize exactly those languages that can be defined by a "regular grammar." There are two other Abstract Machines that correspond similarly to "context free" and "context sensitive" grammars. The first of these automatons is created by adding a "push down memory" to a Finite State Machine. This automaton is called a PDA, or "Push Down Automaton."

A push down memory is a last-in first-out device capable of storing or fetching one symbol at a time. This complicates programming the machine. Now, each entry in the state-input table needs to specify what, if anything, to do with the memory. Valid actions are, push a symbol into the memory or pop the most recent symbol out of the memory. A push down memory, or push down stack, is like the spring loaded stack of trays in a school cafeteria. Trays may be loaded onto the stack, or taken off, but only the top tray is available at any moment. Each program step that pops a symbol out of the memory must also specify what action to take for each different symbol that might pop out. Thus, a program step might have to deal with all the possible input symbols and all the possible symbols that could be popped off of the stack. Usually only a small subset of these would be valid and cause a normal state change. All of the invalid combinations might be lumped together and cause an error handling state to be invoked.

A context sensitive grammar is equivalent to an FSM with a complete Random Access Memory (or RAM), as in an ordinary computer. Now, each state may examine or alter the contents of any location in its memory. One difference between this "Linear Bounded Automaton" and a real computer is that a

computer's program is stored in its memory right along with its data. A computer typically has several sources of input that are general purpose in nature, rather than dedicated to a particular program or application. The abstract machines of Automata Theory deliver their results by halting in a particular state. Real computers normally don't halt. They have a variety of complex output devices that are driven by programs that keep running until the computer is turned off.

Just as the limits placed on production rules limit the types of languages that can be defined, the design limits placed on abstract automata limit what they can theoretically compute. A vending machine with a couple dozen states can't compute very much. A personal computer with a multi-megabyte main memory and a multi-gigabyte hard drive can compute quite a bit more.

The most powerful Abstract Machine of all, the Turing Machine, is simply an FSM with an "unbounded" memory. If you kept adding memory to your computer every time it signaled "out of memory," there would be no limit (in theory) to what it could compute. A Turing Machine has the simplest possible hardware design, but it's perhaps the hardest of all machines to program (develop software for). Its hardware design consists of an FSM and an infinite read/write tape. At any point in its program, it can read or write the tape, move it left or right, and change to a new state. Even though it can only access the nearest symbols at any one moment, it can be programmed to reach out any finite distance to access a symbol. Although slow and inefficient in design, it is nevertheless capable of computing any computable function.

Most of the differences between computers and Abstract Machines are to make computers more useful and easier to program. Computer programs are written as lists of instructions, rather than entries in a state-input table. Input and output are generally done as transfers directly between a sequence of memory locations and a variety of devices such as disks, printers, and visual displays. The kinds of instructions a computer can carry out are things like, "move the contents of memory from one location to another," or "do some kind of operation to the contents of memory" (such as add two locations together and put the result somewhere).

Although computers can modify their own instructions, this practice is carefully controlled. A given program seldom modifies its **own** instructions. The computer is generally directed by an outside agency, such as a human programmer. First a program in the form of a text file is written or edited. Next, the text file is passed through a translator program to produce machine instructions. And finally, the computer is made to execute these new instructions.

Machine instructions facilitate three types of program structure: Sequence, selection, and iteration. The most common structure is sequence. This means that instructions are executed by the computer one after another within the computer's memory. Selection refers to a class of instructions that can change this flow. Based on the contents of some memory location, the next instruction can be taken out of sequence. The third type of structure is really just a special form of selection. It is called iteration. It means that a block of instructions is performed repeatedly until some condition is met, and then the next instruction in sequence is performed.

There is evidence that the DNA language has much in common with all of this. In the first place, DNA seems to express algorithms as opposed to descriptions. It tells what to do and how to do it, not what the result should be. In other words, DNA is like a computer program that lists a sequence of actions, what to do in particular cases, and how many times to repeat something. DNA is not like a tiny model, a blueprint, or a set of construction plans.

Here are some further observations about language and automata theory. First, any grammar or machine program may contain flaws (or bugs). Certain classes of flaws can be mechanically detected, but those in most interesting applications cannot. Debugging is difficult, time consuming, and seldom complete when a product first reaches the consumer. There is no way to prove that you have ever found the last bug in any but the simplest programs.

Second, all real machines and real languages are finite. No real language has an infinitely long sentence, and no real machine can use an infinite amount of time or memory. Real machines may be Finite State Machines, but they have an **extremely** large number of states.

Likewise, a real language could be defined by a Type 3 grammar, but its definition might be astronomically large in a Type 3 format. This is why more complex grammars and automata are needed. The use of push down stacks, random access memories, and more complex rules of grammar allow shorter programs or grammars to define more complex behavior and languages.

The fundamental result of computer science is that a Turing Machine is capable of computing anything that is computable. In theory, this includes the recognition of natural languages, but there is an ongoing debate as to whether it includes behavior complex enough to be regarded as "intelligent." Turing Machines are an abstraction. To be well defined, they must have their entire input recorded on a finite portion of their read/write tape before they are started. Their "program" may also be stored partly on tape (software) and partly in their Finite State Machine (hardware).

Although most differences between the abstract Turing Machine and a real computer are not "important," two are worth discussing. The first is memory. A Turing Machine is "powerful" enough to compute any computable function because it has unlimited memory. A Turing Machine never needs an infinite memory, because that would take an infinite amount of time to make use of. A real computer has a finite, but very large, memory. If more memory is needed, and we add it to the system, this difference is not limiting. In fact, human brains are finite and many of them manage to be intelligent.

The second difference between Turing Machines and computers, seldom noted by scientists, is theoretically important. A Turing Machine does **not** interact with the real world. Its input is finite and defined **before** it starts operating. Its results are delivered when it halts. A real computer can ask questions and learn in the midst of a computation. It can deliver results before it halts (or without ever halting). A real computer can be put in contact with Nature. It can affect the natural world and also take the measure of it. This kind of feedback makes a computer part of a larger process that is not computable. Interaction with a digital tape is completely deterministic; interaction with the natural world is not.

Therefore, it is my belief that modern computers, with their large random access memories, and the ability to interact with their environment and their own programs, have adequate hardware to deal with natural languages and produce intelligent behavior. All they lack is the software.

*Expert systems* were an attempt to rectify this. Expert systems are composed of production rules. Input and output are in the form of some specialized language and they have an "inference engine" that drives the application of their rules. Essentially, expert systems merely make it easy to write certain kinds of programs. Although they have had a few notable successes, expert systems and rule based programming have failed to make computers intelligent in any general way.

# Neural Nets

*Neural Nets* are conceptually simpler than Expert Systems. They are easier to build and more limited in their applications. They are quite different from standard computer programs, though a computer can easily be programmed to mimic them. Essentially, Neural Nets make decisions and codify knowledge in a way similar to mathematical functions.

Let's review what a *function* is. The standard way to write the generic function (f) is y = f(x). The letter x stands for any value in the *domain* of the function (its input), and the letter y stands for a value in the *range* (its output). Different values of x may produce the same value of y, but no value of x can produce more than one value of y. In other words, x is a valid input to the function and y is the unique output of the function.

Mathematics has invented many different kinds of functions. A Neural Net is just one of the latest. Neural nets are not expressed in the familiar notation of $E = mc^2$, or $A^2 + B^2 = C^2$, it is easier to explain Neural Nets in terms of a model: How they are built and what they can do.

Neural Nets were inspired by, and bear some resemblance to, the networks of neurons in our own brains. A typical Neural Net has a set of inputs, a set of outputs, and a layering of nodes between the inputs and outputs. The simplest Net would have a single input, a single output, and a single node connecting them. (A *node* is simply a point where input and output lines come together.) The purpose of a node is to apply a weighting factor to each of its inputs, add them all up, and deliver the result as its output. Neural Nets that are really useful have anywhere from two to several hundred inputs, two layers of nodes usually with half a dozen to several dozen nodes in each layer, and some small number of outputs each representing a different outcome of the decision we want the Net to make. Usually, each input connects to every node in the first layer, and the output of each of these nodes is input to every node in the second layer. Each node in the second layer generates one of the outputs of the net.

Let's design a very simple eye for the purpose of recognizing characters. The fovea of our eye will be 196 dot sensors in a 14 x 14 matrix. There will be some mechanism that focuses one character after another onto this matrix. Each dot of the matrix will be connected to each of the 26 nodes that generate the output (one node for each letter).

This Neural Net is constructed for a specific purpose. The input data must be well understood (samples of graphics for each of the 26 letters mapped into the 14 x 14 matrix). And there must be some way to determine a correct or desired output for any given pattern of input (for each letter, the correct one of the 26 outputs must have the largest value). The trick is to set all the weighting factors at each connection within the net to a value that causes the net as a whole to behave as we want it to.

This is done by subjecting the net to a set of "training data." After each presentation of input, the weighting factors are adjusted by small amounts using trial and error, or some other scheme, so that the outputs are a little closer to what we want. Techniques for "training" a neural net are still being worked out. In some cases it's easy to train them, in others it's more difficult, and for some applications it may be practically impossible, given today's technology. However, once a net is "trained" it can be put to work on real data that follow the same patterns as the training data, but not necessarily exactly. Neural Nets are useful because they can "learn" patterns that are difficult to codify as standard programs or rules to expert systems.

* * * * *

We have just explored the topics of communication, languages, computers and abstract machines. We have seen that these subjects are closely linked, but what do they have to do with life and instructions on how to live it? The answer is that they touch on two important areas. Language and communication are essential to life. Computers, what they are capable of, and how they work are useful in understanding ourselves. They model, in some limited respects, our own brains. Aside from how these subjects relate to ourselves, they are developing areas of science and technology, and are important just to understand the times we live in.

In our everyday lives, language is used to fulfill a purpose. A language is used to record or communicate information. The most compact way to get at the function being performed by a language is to describe it in terms of intention, purpose, and reason. A list of the reasons language is used in inter-human communication might go as follows:

1. Entertainment and exhibitionism.
2. Learning and teaching.
3. Getting and giving instructions to accomplish a goal or to learn a role or skill.
4. Bonding, socializing, and “sharing”; verbal “grooming.”
5. Rehearsal, planning, and design.
6. Informing, answering, and debate.

Consider the articulation of a skill. A skill is more than a knowledge base, it is the ability to carry out a complex activity with some definite aim within a field of endeavor. Language can be used to specify a series of actions or to describe a set of things and their arrangement. Language always presupposes a context. The machine language of a computer presupposes its *order code* (the binary instruction set of its central processing unit). The natural language of humans presupposes their society and psychology.

> It is impossible to dissociate language from science, because science always involves a sequence of phenomena, abstract concepts which recall these phenomena to mind, and words in which the concepts are expressed. To call forth a concept, a word is needed; to portray a phenomenon, a concept is needed.
>
> - Antoine Laurent Lavoisier

The more compact a linguistic expression, the more complex the vocabulary and the presuppositions of the language. The power of a language is its ability to name things. Just like the variables that name rules in the definition of a grammar, names can refer to anything in the context of a language. Computer programs also use this technique. By simply using names, an entire library of prepared code can be referenced and used.

The less a program relies on libraries and conventions, the more it has to explicitly spell itself out. A complex program could explode into an incredibly voluminous expression. It is only the vast and complex context assumed by a natural language that allows each statement in it to be relatively short. Because this context always differs in subtle ways between two users of a language, the chance of a misunderstanding is always present.

The ability to reference and reuse pieces of information and draw upon common libraries is a necessity if a high level of complexity or abstraction is to be achieved in the use of language. Much of the groundwork for acquiring a skill is acquiring the vocabulary and concepts that form the context for it.

# The Mind and the Brain

Is the *mind* more than just a product of the *brain?* Is the brain more than just a machine? Plato asked questions like these about 2500 years ago. He probably wasn't the first. Descartes, over 300 years ago, stated the position of dualism. Dualism is the belief that the physical and mental are indeed separate, and that the mental is the more fundamental of the two. His logic began with the premise that we can doubt everything but our own thoughts. To doubt them leads to an infinite regress. Because we think, we therefore are. Dualism leads some to the belief that God is the universal mind or spirit, and that Nature is His physical counterpart. It leads others to a belief in solipsism: I think, therefore I am, but I can't be sure about you, so only **my** spiritual existence is beyond question.

Another perhaps more scientific position is to begin with the premise: I **am**, and I can **think**, therefore my job is to find out **how** and **why**. We may be **able** to doubt everything except the fact that we think, but does it make **sense** to do so? Our memories appear to be part of our ability to think, and they tell us that thinking was an acquired skill. Neither Descartes, nor anybody else, was capable of making the statement, "I think, therefore I am" during the first few years of his life.

Let's don't take all our thinking skills and use them to deduce the nature of reality from a single first principle. Instead, let's use our thinking skills **as our first principles** and work from there.

## The Stroop Effect

Before we jump into the metaphysical arguments about the difference between the mind and the brain, let's do a quick warm up exercise to get us thinking about how the brain works. The *Stroop Effect* (named after the psychologist who discovered it) has to do with processing delays in the brain and reaction times. Here it is in its simplest form.

A subject is given a list of words that are all names of colors. Each name of a color is, itself, presented in color (a color that need not match the name). For example, the word "yellow" might be presented in green. The task is to name the **actual** color, not the word. We will simulate this by a list of words followed by their color in parentheses. Remember, the word in parentheses is the **color** they **see** and the response they are **supposed** to call out. The word in front of the parentheses is the **word** they **read**, and therefore the one they have been **trained** to say out loud.

Consider the following list: Green (green), Red (red), Blue (red), Yellow (blue). Stroop observed very little hesitation on the first two list items, some hesitation on the third item, and the greatest hesitation on the fourth item. What distinguishes the fourth item is that the (blue) response is apparently still being suppressed because of the preceding item. The word "Blue" presented in red required them to say "red." The printed word "Blue" was incorrect, so they had to suppress that response. Then, the last item was the word "Yellow" presented in blue. This required them to say "blue" but the effect of suppressing that response still lingered. This type of sequence always required the most time to do correctly.

This experiment is an elegant example that shows different parts of the brain working simultaneously as a team and at cross purposes.

# Metaphysics

Metaphysics is part of philosophy. It is concerned with the first principles of existence, or *ontology*. For centuries philosophers have divided reality into mind and matter, and human beings into their counterparts: Souls and bodies. There are two main divisions of philosophy, monism and dualism. The monists believe that the mental and physical are two aspects of a single principle. Some monists, the materialists, believe that matter is real and the mind is an illusion that somehow emerges out of it. Other monists, the idealists, take the opposite point of view: Only the mind is real and without it, the physical universe has no reality. The dualists take the position that mind and matter are truly separate, that one can exist without the other, but that they can also be connected. Philosophers spend their time phrasing explanations for all of this and fitting their explanations into other fundamental beliefs, such as the belief in God, free will, and so forth.

Determinism is an issue that relates to this. The various forms of determinism are rooted in the belief that every cause determines an effect and that every effect can be traced to a cause. Determinism implies that there is no such thing as free will. The most plausible form of determinism, to the scientific mind, is physical determinism. After Newton's laws of motion were accepted by the scientific community, it seemed to scientists and philosophers that the motion of all particles in the universe would determine with certainty the course of future events.

With the advent of quantum mechanics and Heisenberg's uncertainty principle, it was realized that even in principle it was impossible to predict the future positions of particles based on their current positions and velocities because these quantities are fundamentally uncertain. This tends to overthrow any strict form of determinism, but is it any guarantee that we can choose our own destiny by exercising free will?

It turns out that we have ample evidence to believe that our complex universe leaves plenty of room for some things to be deterministic, others to be chaotic (in random, or patterned, or unknown ways), and also for free will. Let's follow the logic of a thought experiment to bear out this assertion.

Consider a simple computer. It has a program that generates 1000 numbers between 0.0 and 1.0 according to some complex formula that computes each number from the previous one. This program starts when any key is pressed on the computer's keyboard. It takes one second for this program to run. When it is finished, the last number is tested and the program prints "yes" if the number is greater than 0.5, and "no" if it is less than that. The initial number is based on the date in the computer's clock chip. On any given date, a different sequence is generated. Now, all of this sounds a bit technical, but the main point is that the computer will always print "yes" or "no" one second after a key is pressed. This is absolutely determined by its program and its state before the key is pressed. Unless you have just run the program and seen the result, or unless you know every detail of the machine and its program, and **simulate** it on **another** machine, there is no way to guess the result better than 50% of the time.

Now, consider the state of the machine before you press a key and activate its program. Let's assume that you could know the exact motion of all the particles making up the machine and the key being struck. Does it make sense to think that any calculation could extrapolate the motions of electrons through the machine during the next one second and improve your odds of guessing whether it will print "yes" or "no?"

Equations of motion, even with infinitely accurate and complete data, simply can't describe the behavior of this system. The information contained in the program is not present, in any useful form, to such

equations. Quantum mechanics tells us that this data and the equations we would plug it into are fundamentally uncertain anyway. And yet we know that the outcome of the program is the same on any given day. It is deterministic. The design of the machine, based on natural laws, makes sure of this.

Thus, machines can be designed with fundamental uncertainty (as we saw in the case of Schrödinger's Cat), or with complexity so great that their behavior can't be predicted by anything less than total knowledge of their construction and a **perfect simulation** to see how they behave. The real world does not follow a script. Most future events cannot be predicted. None of us is destined to face a given situation and make a certain choice. What our futures are to hold, and what we are to do with them, is a product of chance and the very nature of ourselves. Our natures are also partly determined by chance, and partly by ourselves.

So, do we have free will or not? First, there is no way to prove that we don't. Each of us bears the brunt of our own decisions. If believing in free will makes it easier to take responsibility for ourselves, then we should do so. If believing that the point is moot doesn't interfere, then this is also acceptable. It may well be that a deep understanding of any of us might enable an accurate prediction of what we are likely to do in a given circumstance. If so, we ourselves should seek this deep understanding and judge for ourselves if we are satisfied with it. If we are not, we should seek to change. If that's not free will, it will just have to do!

## Augmented Materialism

Let's repeat the questions we started with in this section: "Is the mind different from the brain?" "Is the brain more than a machine?" To answer 'yes' to either of these questions we need some compelling reasons. Since there is no particular evidence that the mind is more than a product of the brain, or that it is more than a very complex machine, the default answer is 'no.' Granted, there is no evidence to decide the question either way. We have no proof that minds can exist without bodies (there is no documented and verified example of such a case), or that the mind's existence without a body is impossible (proof of the negative is tricky at best and, under normal circumstances, it's impossible).

We choose between these two positions based on *Occam's razor*, or empirical parsimony. For now, we accept the **possibility** that the principles that explain a machine are sufficient to explain a brain, and that the physical brain is sufficient to explain the thinking mind. We are simply reserving judgement. Now that we have taken a default position, let's see if we can strengthen it with logic, or construct arguments that tend to refute it.

The default position accepted here is basically the philosophy of materialism, that matter is the primary basis of reality, and that all phenomena can be explained in terms of physical laws. Here however, we use a slightly updated form of materialism. We have already argued that reality consists of more than matter — that there are two other aspects of reality. Matter can interact with itself in ways too complex to predict from simple physical laws. Even an understanding of complex interactions doesn't allow us to derive the reality of information; it is the existence of life that makes the concept of information a necessary part of reality.

Without this Augmented Materialism, the workings of the brain would truly remain beyond explanation using only the laws of physics. Today, science accepts models that employ descriptions of events and processes (interaction). Biological structures and psychological processes are described in terms of purposes (information). Let's accept that reality is still based on matter, but that science includes much

more than just the laws of physics, and that reality is more than just physical existence. This is *Augmented Materialism.*

Now, let's state the default position in more detail. The mind is the result of the activity of the brain. The brain is a physical organ, part of a living being. It can be explained, not directly in terms of the laws of physics, but in terms of concepts that emerge in a complex universe. These concepts allow the construction of models and theories that are fully compatible with the scientific method. Nothing about the mind or the functioning of the brain violates the laws of physics, requires any new laws of physics, or requires any of the existing laws to be changed.

Let's see where this position takes us. Can the mind exist without the brain? Can it exist independently? Could the mind have existed before the brain came into existence? Can the mind exist after the brain stops functioning? Is there any difference between one's mind and one's soul or spirit? The default answer to all these questions is still 'no.' There is simply no evidence to support any of these propositions.

**Are** we a brain, or do we simply **have** a brain? We can chop off an arm or a leg and still be ourselves, right? We can plug in a heart, lung, or kidney machine and do without **some** of our vital organs. We can live on an I.V. bottle instead of digesting food with our stomach and intestines. But, remove our brain or let it stop working, and we no longer exist. We are dead for sure. Therefore, it makes sense to say that we **have** a body, or that we have body parts, but not that we **have** a brain. It is more the case that we **are** our brain (or something that emerges from it). But, it is also the case that our brain is part of our body.

## The Argument for Dualism

There is an analogy between a computer and its program, and a brain and its mind. This analogy compares the mechanical to the living. Life may have evolved from inanimate matter, but having done so, it has invented new and fundamentally different properties. These properties emerge from an incomprehensible degree of complexity. Take any sufficiently simple component of a living organism, and that component can properly be called mechanical. Add them together, and the whole is more than mechanical.

The components of the brain may be mechanical, too. But, the brain has up to a hundred billion neurons and each neuron makes thousands of connections with other neurons. Each of these connections forms a synapse, itself a component so complex we still don't fully understand it. Trillions of synapses make up a single mind-brain. Just as life is something more than mechanism, it seems reasonable that a mind could be something more than a program.

This argument builds a case that life is more than the material and the mechanical, and that intelligence is a non-material counterpart. Thus, this argument moves away from the positions of both monism and materialism.

Using the computer metaphor for the mind and brain, software and hardware can be separated. Software may be stored in different forms and transmitted from one place to another. Hardware may employ different designs and be switched on or off. Software and hardware lead different existences and have different life cycles. Software animates hardware. Hardware allows software to be expressed.

Software may be developed independently of the computer that will eventually run it. Likewise, many computers are in existence for years before a particular piece of software is loaded into them and run.

## A Counter-Argument

A computer without software is useless. Its memory is set to random noise or is simply erased. When turned on, without software, it can produce only heat. What is software without a computer? Software has to have some physical form. If it doesn't exist as electrical patterns in a computer memory, it has to exist in some other form, such as magnetic domains on a disk or tape, or fluctuations on some other surface, such as paper or a compact disc. Computers, brains, and other things, include in their very design both material and software components. Software is capable of being communicated, in other words it may be encoded, transmitted, and decoded, but it always exists in some physical form. It cannot be disembodied. It does not have a special ethereal form unknown to physics. Thus, software is **not** analogous to a disembodied soul or mind.

From what we know about the brain, we know **nothing** that would tell us how to collect its "program" if it has one. Likewise, there is every indication that there is no way to load such a program into a brain. If we wish to use the computer analogy, the evidence we have about the brain is that its software is much more "wired in" than the software in a modern computer. It is stored more like programs were stored in some of the early computers, by wire patch cords. In those days it took hours to wire up even the simplest of programs. The human brain would take over thirty thousand years to wire up at the rate of one connection a second!

Well, surely we could engineer a way around this! Early computers were replaced by ones that used electronic switches instead of hard-wired patch cords. Programs were stored in memory along with data. Programs could be punched into cards and loaded into memory using a card reader. This speeded up the process by orders of magnitude. But, this didn't speed up the patch cord design, it was a whole new approach. As it stands, the brain has no mechanism to read out its program, nor any way for its patterns of patches to be modified from the outside. It would require a complete redesign of the brain to repair this "limitation"!

If we want to use the brain as it is, we are forced to find some way to read out its program and wire in a new one. No one has the least idea how to do this today. Two approaches might get us somewhere in a few hundred, or thousand, years. One would involve some form of tomography with a million or a billion times more resolution than today's technology. The other would require some form of invasive "nanobiot" (a word coined to be a cross between robot, billionth, and biological). An army of nanobiots would be sent into the brain to traverse all of its synapses and record in some DNA-like medium what they found. They would have a three-phase life. First, they would reproduce until their numbers were high enough. Then they would generate the brain record. And finally, they would die and turn into a harmless substance. The record and their remains would wash out of the body and be collected from its wastes.

Taking this information and regenerating another brain based on it would be an even bigger challenge than collecting it. The design and operation of a nanobiot implies controlling life at the level of a virus. Building a brain, based on a readout in the form of a DNA-like record, means controlling life in a way that supersedes the most complex lifeforms we have encountered — ourselves. After all, our own brains are only "roughed in" by our own DNA. As we mature, each of us develops a completely unique brain with a completely unique "program." Life, as we know it (and the only thing we have to base a

design upon), approximates and then adapts. A brain, built to exact specifications, would have to develop on a completely different basis than any life on earth now develops.

* * * * *

Reviewing these arguments and speculations it seems that there is still no reason to believe that a mind could exist independently of a brain. It's barely conceivable that we may someday be able to collect the "program" from a brain. Someday much sooner, we might be able to build brains that are more like a computer, with the ability to store and transfer their "minds" more easily than could be done with a human brain. It's not completely inconceivable that a brain "program" could be translated into a computer program and thereby a mind placed into a computer.

If minds were capable of "readout," storage, and transfer, would the copy be a new mind in its own right? If the original were destroyed and the copy activated, would our consciousness continue on in a new brain? Or would a new and separate consciousness have been created? Again, with no evidence that consciousness can exist independently from our physical brain, there is no reason to suppose that it could "jump tracks" and reappear somewhere else. Therefore, we can only assume that a copy would be a new and independent consciousness.

Very simple brains are below the threshold of intelligence, as are all modern computers. Simple brains evolved into our brains. There is no reason to place a limit on how far computers can evolve. In fact, this whole analogy supports the argument that intelligence **will** emerge from computers at a sufficient level of complexity.

Thus, we conclude that, if there is a difference between computers and the brain, it is simply a difference of degree. The possibility exists that intelligence could emerge from the mechanical, just as life itself emerged. What we can't predict is how complex a machine it will take for intelligence to emerge. Are we years away? Or millennia? No one knows.

## Other Realities

The world best understood by man is described by classical physics. This is a world that is slowly dying a "heat death" in which every event means a loss of free energy to heat. It is a world of cause and effect, where a future state of affairs can be predicted on the basis of initial conditions. It is a world in which life is an anomaly that science has made little progress in explaining. The part of the universe familiar to us is the part in which the very small is observed indirectly, the very large is seen only from a great distance, and the very fast is observed either very briefly, or from very far away.

The realities of the very large and the very small are realities that we can never enter; we will **always** observe them indirectly or from afar. But, this shouldn't stop us from trying to get a better perspective on them. Science builds useful models of them, and technology is based on them. Distance relates to size, and time and distance together relate to speed. The following tables describe the entire time and distance scales of the "known universe" in terms of the familiar units of inches and seconds.

Distance in inches:

| | |
|---|---|
| 1 Femto inch ($10^{-15}$) | the size of a proton |
| 1 Pico inch ($10^{-12}$) | the size of an electron |
| 1 Nano inch ($10^{-9}$) | the size of a molecule |
| 1 Micro inch ($10^{-6}$) | the size of a virus |
| 1 Milli inch ($10^{-3}$) | the size of a grain of salt |
| (one inch) | the size of an egg yolk |

| | |
|---|---|
| 1 Kilo inch ($10^3$) | the height of an 8-story building |
| 1 Mega inch ($10^6$) | the distance across a large city |
| 1 Giga inch ($10^9$) | the distance around the earth |
| 1 Terra inch ($10^{12}$) | the distance to the nearest planet |
| $10^{15}$ inches | twice the size of the Solar System |
| $10^{18}$ inches | the distance to the nearest star |
| $10^{21}$ inches | .. to the center of our galaxy |
| $10^{24}$ inches | .. to the nearest neighboring galaxy |
| $10^{27}$ inches | .. to the edge of the known universe |

Time in seconds

| | |
|---|---|
| $10^{-24}$ seconds | light crosses a nucleus |
| $10^{-21}$ seconds | period of nuclear vibration |
| $10^{-18}$ seconds | light crosses an atom |
| 1 Femto second ($10^{-15}$) | period of atomic vibration |
| 1 Pico second ($10^{-12}$) | period of molecular rotation |
| 1 Nano second ($10^{-9}$) | light travels one foot |
| 1 Micro second ($10^{-6}$) | period of a radio wave |
| 1 Milli second ($10^{-3}$) | period of a sound wave |
| (one second) | period of a heartbeat |
| 1 Kilo second ($10^3$) | light travels across earth's orbit |
| 1 Mega second ($10^6$) | a fortnight (two weeks) |
| 1 Giga second ($10^9$) | an average lifespan |
| 1 Terra second ($10^{12}$) | the age of the pyramids |
| $10^{15}$ seconds | the age of intelligent life on Earth |
| $10^{18}$ seconds | the age of the universe |

What happens when we depart from our own reality by a factor of a billion (just three lines in the above table), in terms of size or speed? Let's see what reality would be like in regions like these, far away from our own in terms of size and speed.

## The Very Small

This realm begins where our ability to see it directly, leaves off. By using a magnifying glass we can enlarge things a bit. With a strong microscope we can see things that simply can't be seen with the naked eye. A very strong microscope shows us Brownian motion, the evidence for the existence of molecules. This is the motion exhibited by very small specks seen under a microscope: They appear to jump about at random for no apparent reason. The "reason" turns out to be that a relatively energetic molecule impacting a barely visible speck causes it to recoil just like a billiard ball would move slightly if shot at by a BB.

The world at the level of molecules, measured in units of a billionth of an inch, is governed by quantum mechanics, not by classical physics. Reality at this level has virtually nothing in common with reality at our level. On the scale of the very small there is no such thing as heat or friction. The effects of gravity are almost unnoticeable, while the effects of static electricity are completely overwhelming. There is no such thing as light or sound as we know them; these phenomena are transformed into different things entirely. On the molecular level, light is an unseen jolt of energy that is emitted or absorbed by a molecule, instantly and violently knocking it, or a part of it, around or loose from whatever it was connected to. Sound cannot be distinguished from heat, and both of these are simply the degree of knocking around that's going on. This "degree" would be measured at a point in space, at a given time,

and in terms of both rate and violence, if it could be measured. But, it can't — not at the scale of molecules and atoms. There's nothing to measure it against, and there is nothing to see it with. In fact, there is no way to scale or "shrink" any kind of observer down to this level.

Of course, we can **imagine** ourselves at the level of a molecule, even if there is no possibility of actually **being** there. Soon, computers will be able to generate a virtual reality that will assist our imagination. But, there are two things about the reality of the very small that even a computer cannot handle. First, there is no way to "see" what's going on. We would simply have to "make up" something for things at that level to "look" like. Second, we would have to slow everything down by a factor of about a million or a billion, so that we could follow the action. The point is that the world of the very small is a totally alien reality. Without turning it partly into fiction, it's physically impossible to imagine. We possess neither the alphabet, nor the grammar.

Consider a size only a tenth that of our own. Any smaller than this, and it's extremely unlikely an organism with our intelligence could exist. When you reach a factor of a thousand smaller than we are, you reach the limits of how small we can directly build a stand alone "machine." The term "nanotechnology" has been coined to describe possible machines ("nanobiots") in the range of a micro-inch. These machines would basically be "designer" molecules. We will need to control biochemistry to fabricate anything at this level. Machines smaller than this cannot exist according to science as we know it.

## The Very Large

As we go up in size from ourselves, we again enter a different reality. On a scale of about a billion times our size, gravity begins to be the paramount force. Space is virtually empty. It is noticeably "bent." Light takes a significant time to get anywhere. And everything else seems to be standing still.

Certain aspects of the very large are not difficult to imagine. We can gather light into very large lenses from very far away, and see what exists on a very large scale. However, we can only see a 50-100 year "snapshot" of the universe because our lifespans are so short compared to the timescales of the cosmos. Events on this scale happen very slowly and over a very, very long time.

A simple example of the effect of size is growing a water droplet. At some point it reaches a maximum stable size, and the addition of more molecules of water to the droplet will cause it to divide in two. This is because of the relation of its surface tension, which contains it, to various forces inside. Atoms and molecules cannot be shrunk or enlarged, we can merely aggregate more or fewer of them to have larger or smaller objects. And even this principle only works over a certain stable range.

Unlike events on the molecular scale, events on larger and larger scales are more and more varied. Although things happen very fast on a molecular scale, not many really different **kinds** of things happen there. The same events happen everywhere, indistinguishable from one place to another. On the scale of planets and stars, nothing ever happens **exactly** the same way twice (though there **are** strange attractors). The variations and possibilities are endless. From our small corner of the universe, we have seen a little and we have guessed about a little more. But, on the grand scale, the universe is so complex that we can only begin to dream about its realities. And much that's out there is simply beyond our ability to imagine.

However, we can all imagine a man about ten times taller than ourselves, say about sixty feet tall. He would be about a hundred times stronger than we are. This is because his strength is proportional to

the area through a cross section of his muscles, and area is the square of linear distance. Thus, if he is ten times as tall, his muscles would be a factor of 10 x 10 as strong.

He would weigh a thousand times as much as a six foot man. This is because weight is proportional to volume, or the distance cubed. At the same proportions, if a six foot man weighed 180 pounds, a sixty foot man would weigh 180,000 pounds. If a six foot man could lift himself and another 200 pounds, a sixty foot man could lift a total of 38,000 pounds (a hundred times the 380 pounds a six foot man can lift). This leaves him almost a factor of five short of even being able to lift his own weight.

The net effect is that a 60-foot man would simply collapse. He not only couldn't stand up, but his bones would actually break if he tried to do so. The principle involved here is called the *square-cube law*. It works in both directions. It explains why ants can lift many times their own weight. Smaller animals get the advantage of greater strength in proportion to weight, just as larger animals get a disadvantage. The largest animals live in water where their weight is partially supported for them. Elephants have very thick legs as compared to horses. As animals get larger, their bones and muscles have to get larger faster than their height increases to keep up with the fact that weight increases ten times faster than strength.

The square-cube law puts a kind of limit on how big our engineering feats might eventually grow to be. On a planetary surface, there is an upper limit to how large a structure can be built before it is crushed under its own weight. In space, we find that there is a limit on how large an asteroid can be and have an irregular shape. Larger than this limit, and asteroids produce enough gravitational force that they collapse into a more or less spherical shape. With better materials, and a honeycomb design, structures could probably be built that were several miles in diameter. Much larger than this, and designers have to consider that strength increases only a tenth as fast as the effects of mass and inertia.

The point of this is that our technology, our very existence and reality, are bounded by size. The very large and the very small are outside of our reality. We can look, but we can't "touch."

## The Very Fast

The realities of the very small and the very large are realities that we shall never directly know. Our experience with the very small comes only from indirect observations. Our experience with the very large is much like trying to deduce the nature of the world from a few snap shots. The realm of the very fast is different from either of these. This is a realm we may someday be able to enter. But, we have much less knowledge of it now than we do of the very large and the very small.

All of our experience of the very fast involves indirect observation of small numbers of fast moving, elementary particles. We have never seen an object even the size of a BB moving at near light speeds. Above, we learned that reality is totally different at a billion times smaller or larger than we are. Likewise, the absolute limit of speed is about a billion times as fast as a slow walk.

Einstein described the model of space-time that is accepted by science today. It makes clear that all electromagnetic radiation travels at the same speed, no matter from what vantage point it is observed. This is the speed of light. Light travels at 186,000 miles per second. That's two-thirds of a billion miles an hour. We've been able to reach speeds of about a thirty-thousandth of that. The only way to go faster would be to expend larger amounts of energy. To get anywhere close to the speed of light would require a totally new technology.

The first factor of ten came from the automobile. It took us from an 18 MPH running speed to a 186 MPH "land speed record" sometime in the early twentieth century. A rocket motor moved the first man another factor of ten to 1,860 MPH in the mid-twentieth century, and to 18,600 MPH in orbit around the earth a few years later. Thus, after a million years of being stuck with an 18 mile an hour speed limit, we pushed the frontier back by three orders of magnitude, three factors of ten, in a little over 50 years.

Now, forty more years have passed and we have made little progress in going any faster. In fact, it looks like rocket technology has about reached another speed limit. To move from 18,600 mile per **hour** to 186,000 miles per **second**, an increase in speed of 36,000 times is necessary. It seems unlikely that this will happen during the next hundred years or so, since both the need and the technology would have to be discovered. This kind of speed is simply not necessary for interplanetary travel. When our descendants do figure out how to travel very fast, they will be able to leave our solar system and travel to the stars.

Once man is able to travel near the speed of light, how will his reality change? Scientists know that particles normally taking one microsecond to decay, can take two microseconds to decay if they travel at speeds sufficiently close to that of light. This has been demonstrated in the lab. Such particles appear to age more slowly than normal and that's why they take longer to decay. Time actually passes more slowly for the moving particle than it does for the observer who is standing still. This has also been demonstrated by sending a super-accurate clock up in space and bringing it back to earth. Even though the speed difference is much smaller than that of light, the clock that went into space is a fraction of a second behind the ones here on earth.

This is known as the *twin paradox*. It takes its name from two hypothetical twins that live in our distant future. The twins have just reached their 21st birthday. One of them has graduated from the space academy and is being sent out into space. The other will remain on earth.

Twenty years pass (from the point of view of the twin who stayed on earth). The space traveling twin now returns. During the time he was away, this twin has spent most of his time traveling at nearly the speed of light. As they get back together, they realize that they are no longer the same age! The earthbound twin is about to celebrate his 41st birthday, but the space traveling twin has only celebrated 31 birthdays!

This is called the Twin **Paradox** because speed is supposed to be relative. From earth, it may appear that the twin in the spaceship is moving away at nearly the speed of light, but from his point of view the people on earth seem to be moving. If the two situations were symmetrical this would be true, but they aren't. The twin that travels away, comes back. His spaceship has had to accelerate away, and it has to accelerate again in order to return.

Is it merely the difference in acceleration that "explains" the paradox, or is it the distance and speed traveled? The theory of relativity is based on the premise that there is no way to tell the difference between acceleration due to gravity and that due to changing velocity. The twin on earth is subjected to exactly 1G of acceleration during the whole twenty year period. A single year in a space ship at 1G acceleration would get the ship moving up to a sizeable percentage of the speed of light.

Forget acceleration and speed for a moment, and consider subjective time and distance. If one twin travels at nearly the speed of light for twenty years, he will travel a course that appears to his earth-bound twin to be nearly 20 light years long. However, since the traveling twin only got 10 years older from his own point of view, he couldn't have traveled more than 10 light years without seeming from his own point of view to exceed the speed of light. This would imply that at near light speeds, relative to a

framework of stars, the framework would seem to shrink in the direction of your travel. This “length contraction” is also predicted by the Theory of Relativity.

Therefore, if you were traveling to the nearest star, four light years away, and you approached the speed of light enroute, the distance to the star would now seem to be **less** than four light years from your point of view. You would naturally arrive in less than four years from your perspective, even though a full four years would be experienced on Earth. In this way, if you could travel as close to the speed of light as you wished, you could get anywhere in the universe in as little subjective time as you wanted, because the distance you would need to travel would become arbitrarily small as you approached the speed of light arbitrarily closely.

This consideration leads to a reasonably simple explanation of the twin paradox. Consider a spaceship that travels four light years to the nearest star. Suppose, it and everything in it are accelerated instantly to almost the speed of light. The ship takes one hour of subjective time to reach its destination. Then let’s say it turns right around and comes back at the same speed. A total of two hours of ship time and eight years of earth time will have elapsed.

During this experiment, a TV signal is beamed from the spaceship to earth, and another from earth to the space ship. Each signal is a video of what is happening on earth or on the ship. During the voyage the ship records the signal from earth and earth records the signal from the ship. Let’s see how these two recordings differ.

From earth’s point of view, the trip out and back takes a bit more than eight years. Since the ship travels at almost the speed of light, it takes the ship one year to travel a light year. It takes four years (from earth’s point of view) for the ship to travel out, and four years for it to travel back. The TV signal arriving at earth after two years is coming from one light year away. In four years it comes from two light years away. In eight years, it comes from four light years away. In other words, after eight years the people on earth are getting a signal that shows the ship just as it arrives at the far end of its journey. It turns around, and begins its trip back.

Now, from earth’s point of view, the ship is coming back almost as fast as the signal it is sending. From the four year mark to the eight year mark on earth, the people on earth imagine that the ship has turned around and is coming back, but the signal they get just shows the second half of the trip out. When they finally get the signal that shows the ship turning around to come back, the ship is only milliseconds away from earth. Now, for about a twentieth of a second, they get a signal showing the one-hour return trip. Then, the ship arrives back on earth.

The TV signal from the ship shows one hour elapsing on board during the whole eight years that have gone by on earth. Thus, the signal has been slowed down by a factor of 1 hour to 8 years (1/70,080). This slow-down is observed as a frequency shift. If the signal were sent at a frequency of 10,000,000 Hz, it would have been received at a frequency of 142.7 Hz.

From the ship’s point of view, the trip takes about two hours. It is receiving a signal coming from earth. During the trip away from earth, the ship gets a signal shifted down the frequency spectrum just like those on earth get from the ship. It gets a one hour signal at 142.7 Hz. This represents about 51 milliseconds of time on earth. Now, the ship turns around and starts back. Since it is heading into the signal, the signal is shifted by a factor of 70,080 up the frequency spectrum. Now, for the next hour, at a frequency of 701 Gigahertz, the ship watches about eight years go by on earth.

This explanation is based on length contractions and time dilations that we know occur when relativistic speeds exist between two frames of reference. The difference between the ship and earth is that on earth, eight years are spent observing a signal shifted to a lower frequency. This is called a red shift, because when light comes from a source moving away from us, it appears shifted toward the red end of the spectrum. Likewise, the people on earth only see a blue shifted signal coming from the ship during the moment just before it arrives. The people aboard the ship see a red shifted signal from earth during their trip away, and a blue shifted signal during their whole trip back. From their point of view, the same amount of time is spent observing each. Red shifted signals show time slowed down, blue shifted signals show it speeded up.

Since we know how long each party observes the signal coming from the other, and the amount of red or blue shift involved, we can clearly see the elapsed time differences. Earth observes a red shifted signal for eight years, then a blue shifted signal for just a moment. Aboard ship, they observe an hour of red shifted signal, then an hour of blue shifted signal. Thus, earth observes an hour's worth of time slowed down by a factor of 70,080 and an hour's worth of time speeded up. Aboard ship, they observe a moment's worth of time slowed down, and a full eight years' worth of time speeded up.

Subjective time, like the speed of light itself, always appears to go at the same rate. However, when you observe **another** frame of reference, like we did above using the TV signal, you may note that time is passing either faster or slower in that other frame. The limit is that time may slow almost to zero or pass arbitrarily fast in the other frame, but it can **never appear to run backwards**.

Thus, our understanding of reality (based on Einstein's Theory of Relativity) leads to two conclusions. If we could travel as close to the speed of light as we wished, we could travel to anyplace in the universe and as far forward in time as we wished. The bad news is that the farther away we travel the farther into the "future" we **have** to travel. This only becomes apparent when we return to our point of origin.

Why can't we travel back in time? Travel back in time would imply traveling at a **negative** speed. This is simply undefined. Speed has a magnitude between zero and the speed of light. You can go in the opposite **direction**, but not at a negative **speed**. The concept of negative speed would imply an understanding of the universe **very** different from the one we now have.

* * * * *

This and the previous chapters have talked about some of the ways a logical mind thinks, and some of the things logical minds have come to believe. Someone said if you can conceive, and you can believe, you can achieve. Maybe so, but only if the word **believe** implies a logical translation of a dream, a concept, or an idea into **reality**. Belief that is nothing more than faith, has nothing to do with achievement. There is no limit to what is possible. An infinite number of things **are** possible, but **not** anything and everything.

In school we are taught that questions have right answers and wrong answers (very few right ones and lots of wrong ones!). But, this is like statements being either true or false. We have seen that some statements are neither true nor false, and some may appear to be one or the other, but can't be proven so. Likewise with answers to questions. Some answers are more or less right or wrong than others. There are good wrong answers and bad wrong answers (just as there are flip right answers and deep right answers). Some wrong answers might even be **better** than some right answers (in terms of usefulness).

Not all possibilities are equally possible, some are impostors, illusions, or misunderstandings. Movies and fiction can show us people that travel backward as easily as forward in time, and shrink or expand in size. These are complex subjects, and they lie well beyond the realm of our experience. With these first two chapters as background, let's continue our journey of understanding with a subject that's a little closer to home.

Each of us has one very difficult subject that we should try very hard to master. That subject is ourselves. In the next chapter, we'll take a look at ourselves and get more specific about who we are, and more mundane about how to live our lives.

# III. Better Knowing Ourselves

We need to know ourselves before we can fully know and appreciate others. Likewise, we need to know and interact with others before we can understand the process of growing up. This understanding will help us raise better offspring. The irony is that we **live** these things in the opposite order: We grow up, we learn about others, and finally we try to understand ourselves.

To live an effective life we first have to know how to treat and maintain ourselves. The body and the brain have much in common. They are in constant interaction with one another. But, for the purpose of understanding them, and knowing how to treat them, they will be covered separately.

## The Body

What's important to know about *our body*? For example, how does it work? How should we care for and feed it? What can go wrong even if we treat it right?

The body is a factory that builds and handles organic molecules. This factory is run entirely by automation. The robots and machines are very complex molecules called proteins and nucleic acids. The information and instructions, used to build all the machinery of the body (and make copies of itself) are contained in a special and very complex form of nucleic acid called DNA.

The body can make thousands of different proteins. Each protein has a particular specialty in the operation of the body. Some go into the structure of the body, such as skin, hair, fingernails, bones, muscles, and so forth. Others fight disease and invaders of the body. Still others are used to assist in the steps of various chemical processes. One fundamental process is the supply of energy to all the other processes the body has to carry on.

Energy is required in very small amounts to drive every operation in every cell of the body. Even within a single cell, a fantastic number of operations occurs each second. Fortunately, each one of these takes only a very small amount of energy. The entire body is permeated by a system called the circulatory system. Within this system and a few other spaces within the body, there are different kinds of plasmas, or liquids, containing raw materials. Blood is the plasma of the circulatory system.

The circulatory system pumps blood throughout the body. Blood helps distribute energy by carrying sugars, fats, and oxygen. These and other raw materials pass through the cell walls and sort of kick around and bump against the proteins in the cell. None of the molecules in the body "knows" where to go. They may be **allowed** into certain areas and **restricted** from others, but generally they just diffuse equally and at random wherever they are **able** to go.

The shape of a protein determines what it does. Most molecules bounce off of each other when they collide, but some stick together. The shape of a protein determines which other molecules it sticks to. When two molecules stick, energy may be exchanged, and one or both of them may change shape, causing something to happen. They **may** pop away in new forms. One of them may be unchanged and the other broken apart, or they may break apart as entirely different molecules. Now they bounce

around again until each sticks to something else, exchanges energy again, and causes something else to happen. The body is also divided into compartments with cell walls and other membranes. Some kinds of molecules can pass through these membranes and others can't. This is how the body gets rid of waste, and how it keeps certain molecules confined to certain areas, such as in (or not in) the area of the brain.

Biochemistry studies the sequence of energy exchanges that go on in bodily processes. It attempts to determine the shapes of molecules in chains of events that lead to things like getting energy from the breakdown of fats and carbohydrates. We have a lot to learn about these processes, and we can expect many scientific advances in this area.

The important lesson we can learn from what science has discovered so far is what to eat and how to keep fit. There are some simple rules for what to eat. Eat different foods; don't always eat the same ones. One way to be sure you do this is to cover all of the basic food groups: Protein rich foods, vegetables and fruits, grains and breads, and "dairy" foods. Within each group, choose foods low in fat and sugar and high in roughage or fiber. Some of the best foods are chicken, white fish, beans, virtually all fruits and vegetables (steamed or raw), whole grained cereals and breads, and skim milk. Some of the worst are butter, margarine, cream, and lard or oils (used to fry things). Another way to judge a food is by the amount of cooking or refinement it gets either before or after you buy it. The more preparation food gets (and often the longer its shelf life), the less its food value to your body's chemical factory.

The more fit you are and the more exercise you are getting, the more you can eat even the worst of foods and not endanger your health. This especially applies to children, and then it applies less and less to most of us the older we get. The primary danger to health is to eat too few foods and consistently the wrong ones. The body gets fit and remains fit by making all its different proteins. When a protein is not used, its numbers within our body, and our body's ability to make it, both decrease. Some proteins fight disease. When the immune system is not used, it becomes more vulnerable. Some proteins help convert fat and oxygen into energy. When most of the energy requirements can be met by converting sugar into energy, fat tends to be stored for later use. Thus, we have to keep exercising all of these systems if we are to remain fit.

The simple route to fitness is to spend more time shopping for different kinds of fresh ingredients and preparing them yourself. Spend an hour or two a day on your feet, preparing your meals, pushing a vacuum cleaner or lawn mower around your house, washing dishes, ironing, or whatever. Walk or ride a bicycle if it's safe and you can afford the time. Climb stairs. Spend at least a half an hour a couple of times a week in a crowd that includes some children. Breath fresh air as often as you can. Smell the natural perfumes and pollens. In other words, expose yourself to a variety of activities and natural organic substances.

Don't do anything so much that you wear your body down or require it to repair itself too much (this includes the obvious, like smoking, but it also includes things like running too much and getting too much sun). But do all of the things mentioned above regularly and evenly, and you won't have time to do one thing too much. It may take a while for some people to overcome allergies, cravings, or other mindsets or habits that stand in their way of following this plan, but almost everyone can and should succeed.

The two key words are <u>variety</u> and <u>moderation</u>. This is fundamental advice for a long and pleasant life. For most people, it's no more complicated than this, and you shouldn't try to make it so. The rules are

easy to understand and you don't **need** a shelf full of books, special diets, or a gym full of equipment, though it could **entertain** you to have them.

A few people are born with genetic deficiencies. This means that there is a mistake in their DNA that prevents them from making useful versions of certain proteins. When that happens they are said to suffer from some sort of disease (such as sickle cell anemia). Often, the correct code is found in the DNA from one of the parents, so production of the affected protein may be at least at half strength. Activity that calls upon this protein should be done carefully. This is an area where medical advice and help could improve, or even save, your life. Some people with an allergy or two may have a genetic deficiency, but most people that "have allergies" simply need to exercise their systems to get them "fit" again.

A fit system is one that is forced to burn fats, not just sugars and carbohydrates. This requires a little aerobic exercise from time to time. A fit system needs to get out doors, into crowds, and into the country from time to time. It needs sun, fresh air, and a varied diet of both food and exercise.

Other than getting special enzymes to counteract genetic shortfalls, and the setting of bones and closing of severe wounds, your body has its own machinery to deal with almost every problem. This machinery has to be used to remain in good repair. Of course, sometimes it can use a helping hand. Vaccinations, for example, help prepare us to fight certain diseases before they are encountered. And, of course you should seek an antidote if you think you have been poisoned, or if your immune system seems to be losing a battle with some particularly nasty disease or infection. That's why there are doctors. But remember, doctors can only **treat** you; your body has to **cure** itself.

Most people know they need a varied diet and set of activities. Too much time in the sun and exercising to the point that your body has to kick in with its natural pain killers (going after the "runner's high" for example) is almost as bad as no exercise at all. Over the years it's not clear which is worse, too much, or not enough. The desired objective is to make the right amount of **moderate** activity part of your daily routine.

Some people may find that they have gotten a long way off this track. If so, the warning "consult your doctor" should be heeded. You are off track either through carelessness or for psychological reasons. In fact, carelessness **has** a kind of psychological root.

The psychology of keeping fit is worth discussing further. Some people develop a feast or famine approach toward food and exercise, turning on and off, too much of one and not enough of the other. Balance and consistency should be the objective.

The average Westerner is somewhat overweight. Many are quite a bit overweight. There is a price to pay for carrying around that extra weight, and little benefit in modern society. The price is higher when a lot of extra weight is carried during teenage. The price is paid in terms of poorer than average health and shorter than average lifespan.

Eating is a voluntary activity that can become linked to compulsions that are difficult to control. Here is how it works. The body produces hormones that the brain responds to. Behavior that affects any of these hormone levels tends to become "trained." This applies to many basic need-behavior loops. We have eating needs. Hormones reflect these needs. Hormone levels change as a result of behavior that satisfies the needs. The needs are fairly predictable, we all have them. But people develop a large range of behavior that responds to their needs. We don't all have the same habits, feel urges in the same way, or employ the same behavior patterns.

People have evolved to eat a number of small meals during the day and sleep during the night. After eight hours of sleep, our blood sugar levels are typically low and the body signals us to consume sugars and carbohydrates first thing in the morning. This is done by producing hormones that arouse us to activity. Other hormones make us feel satisfied if sugar and carbohydrates are eaten. Any behavior that causes them to follow in sequence becomes "trained." In the late afternoon, in a similar fashion, our body signals us to eat proteins and fats (to be stored away during the night). This is an effective strategy when food is scarce and may be unavailable at times. In any case, we develop behaviors that are responsive to the cyclic rise and fall of our hormone levels.

If you are overweight you can do one of three things. First, you can adopt new responses to the hormone levels that signal specific hungers during the day. Second, you can get more exercise. Third, you can cut down the number of calories you consume. All of these are called for, but the last is really the bottom line.

## A Diet for Those Who Need One

Here is a diet to replace all the ones you've ever tried. If you aren't overweight, skip this section. If you are, plan on this diet for the rest of your life. Most diets are adopted as a temporary means to an end. That's where this diet is different. It begins by cutting calories, but in the long term it can affect your behavior and give you the extra energy you need to exercise more. Designate three to six days each week (if you can make them consecutive and follow your plan exactly, three days might be enough, but if three days aren't enough to achieve your weight objectives, add more). These will be your "self control" days. The rest of the week you can do whatever you like. Hopefully, over the course of several years you will find your behavior during your "off" days coming more under control. Your cravings, energy levels, and other drives will begin to even out as "self control" becomes a habit.

On your "self control" days, you need to follow a plan that you set out for yourself. Until you get the routine down pat, make a list. During these days you need to eat about 1200 calories (give or take 200 depending on your height). You also need to spend more time than normal on your feet. Write down exactly what you will eat and what your activities will be. Then do it!

Some guidelines for the diet: Drink only water, skim milk, black tea or coffee, diet colas, or 2 ounces of red wine mixed with 8 ounces of soda water (in order of best to worst). Eat four times a day, from 200 to 400 calories each for breakfast, lunch, dinner, and a snack a couple of hours before bedtime. Between meals, eat nothing, and drink only water, tea, or coffee. The best activities to keep you on your feet are ones that you have to do anyway (or pay someone else to do). Shop for your own food. Make your own bed. Fix your own meals. Do the dishes. Clean the house. Mow the lawn. Walk part way to work. Climb a few flights of stairs. The best exercise is regular, frequent, and moderate. The worst is sporadic and extreme (or none at all!).

Make a plan for exactly what you are going to eat and what you are going to do on each of your "self control" days. Write it down and follow it exactly. On the plan itself, check off what you actually did. List any "extras" that you did. Weigh yourself before getting dressed each morning and write that on the plan, too. File the records in a shoebox or on your computer. It's more important to **keep** the record than it is to review it. Make it all part of a ritual and get completely involved in it.

# A sample Control day's diet

## Breakfast

A 6 oz. glass of unsweetened grapefruit juice (better yet, tomato juice).
One piece of whole wheat toast with a thin coat of peanut butter. Coffee.

## Lunch

An apple.
One piece of whole wheat bread or toast with 3 oz. of meat or cheese (add lettuce, tomato, and mustard as desired). Water.

## Dinner

A 3 oz. piece of marinated, grilled chicken breast.
A 6 oz. portion of steamed cauliflower.
A 6 oz. portion of steamed broccoli.
Two oz. of red wine mixed with soda water.

## Dessert

Half a banana.
A 3 oz. portion of low fat ice cream.

Lots of substitutions are possible for these sample menu items. In fact, it is important to substitute in order to get the variety you need. But don't increase the portions or total calories. Be creative with seasonings, relishes, and marinades. Stay away from high calorie sauces, spreads, and dressings.

A good meat marinade can be made from 2 tablespoons lemon juice, 1/2 cup soy sauce, 1/2 teaspoon Worcestershire sauce, a dash of Tabasco, a dash of ground ginger, 1 teaspoon of sugar, 2 tablespoons brandy, garlic powder and liquid smoke to taste. Keep the marinade in the refrigerator and use it for several diet days.

As examples of substitutions, half a can of water-packed light tuna mixed with some pickle relish is a good substitute for the lunchtime sandwich. A small piece of marinated beef filet is a tasty substitute for the dinner time chicken. And, as other examples, you can substitute melon or grapefruit for the juice, and carrots or snow peas for the broccoli or cauliflower. But, don't stop there. Keep looking for new foods.

The older a person gets, the more important it is to keep the body fit in the way described here. Your brain and nervous system are part of your body, and their health is the second key to living a long and happy life.

# The Brain and Nervous System

The basic unit of our nervous system is the nerve cell. A single nerve cell consists of a set of dendrites, or branching fibers that connect via a trunk to the main nerve body. The tip ends of a dendrite are

"keyed" to a variety of chemicals. When one of these chemicals comes in contact with the tip of a dendrite, it affects the nerve. This is accomplished by the "sticking energy transfer" involving differently shaped proteins described earlier. The effect of this may cause the nerve to fire, or it may inhibit the action of the nerve. There may be other ways that action at a dendrite could affect a nerve by causing subtle changes within it. Science is still developing this picture.

From the main cell body of a nerve, an axon stretches some distance away. Both dendrites and axons are very thin fibers. Dendrites sense input in the form of chemicals to which they are sensitive and between which they may have different responses. Axons conduct nerve impulses away from the main nerve body to a distant point at which they secrete chemicals (called neurotransmitters) that can trigger the dendrites of other nerves, and so on.

The brain consists of up to a hundred billion of these nerves all tangled up and connected together, sensing and stimulating one another. The nerve cells look like a tangled mess, but there is a great deal of organization in the brain. It's very important where a nerve is located in determining what it does. The dendrites of some nerves are close to the surface of the body. These trigger sensations. Sensations are the raw information for perceptions.

Perceptions lead to consciousness, comprehension, and thinking as more and more brain stages are utilized. This inner processing is sensed much as raw sensations are, but each sensation has its own quality and not all sensations feed directly into consciousness.

Primary sensations (those from the "outside") are called *qualia*. Higher order sensations (also called perceptions), are developed (learned) in the natural course of maturation.

Consciousness is the concurrent sensation and perception of all the brain areas that we might be feeling or experiencing at a given moment. Much of sensation and all of perception is learned. These are skills, developed and improved by practice. We may have only five basic senses, or qualia (taste, touch, sight, hearing, and smell). But we may develop many, many **perceptions**.

An example is the perception of our native language. Every normal human being seems to develop this faculty if given a chance.

Experiments in hypnosis and observations of certain subjects have suggested that the contribution of a given brain center to conscious awareness can be switched on and off. Other experiments demonstrate that the brain has a well developed ability to either fill in, or be completely unaware of, gaps in its perceptual fields. Just as we fail to see small areas near the centers of our visual fields due to the blind spots in our eyes, anything missing from our conscious awareness is **not** made conspicuous by its absence.

Another interesting experiment has demonstrated that there is about a half-second between the neural activity that signals a voluntary motor activity and our conscious intent to initiate that activity. Conscious activity seems to be initiated unconsciously about half a second before we think we have consciously initiated it. This makes the connection between our conscious awareness, our unconscious mind, and our intentional will, more mysterious than ever.

Our brains are like filters, certain things are caught and other things pass right through. They catch what they have learned to recognize, but only when our **net of attention** is spread. We know that we are sensitive only to very narrow bands of radiant and acoustic energy, but how many other messages fail to get caught in our nets? Experiments on animals show that they are singularly focused on that which will feed them, and that which might feed **on** them. Frogs pay no attention to a freshly killed fly.

Unless it moves in the expected way, a frog doesn't even **see** the fly. How many unsuspected blind spots do **we** have?

> Each man deciphers from the ancient alphabets of nature only those secrets that his own deeps possess the power to endow with meaning.
>
> - Loren Eiseley, 1964

What we do perceive, what finally makes its way into our awareness, we call consciousness. Consciousness is part of our individual reality. It is a product of physical processes carried on within our bodies, primarily by our brains—processes that create, store, and use information.

The realities of non-living entities are connected into a greater reality primarily by the flow of energy between them. If there is little flow of energy between two entities, there is little connection between them, and they have largely separate realities. Information plays no part. Patterns have no purpose. And, complexity is a reflection of chance, not design.

The reality of a living thing is quite different. There is significance in the position and motion of almost every atom in its body in relation to those nearby. There are also myriad patterns over much greater distances than a few atomic diameters. Of course, non-living objects have large scale patterns too, but they are fewer in number and less intricate by orders of magnitude than those in a living thing.

Thus, what counts is the complexity of structure, the complexity of system dynamics, and the amount of information used.

Living entities are marked by the fact that they have very strong connections with other forms of life and with their environment. The realities of living entities are connected into a greater reality not only by flows of energy, but even more by flows of information. Living entities (and some of their artifacts) are the only things we know of that spontaneously create information out of energy. This ability is a fundamental property of life.

Our consciousness is one of the most significant parts of our individual reality. We need to complete our definition of reality with a definition of consciousness. Consciousness is rooted in sensation. Sensation is the "feeling" generated by our nervous system when it comes in contact with a form of matter or energy to which it is "sensitive." For example, our tongues have salt receptors. When salt comes in contact with our tongue, we experience a particular sensation. When blue light enters our eyes, we have a different sensation. When the sound energy of middle C enters our ears, we experience yet another sensation. These sensations, or qualia, are basic. The quality of sound compared to color is very different. This is because they use separate areas of the brain.

The higher level sensations are perception and awareness. When you see or hear the word "election" or "erection" you perceive two different and quite unique concepts. When you were four years old, you were able to hear these two words very nearly the same as you do today, but you perceived them quite differently.

It appears that every task of performance or perception occurs within a cluster of neurons largely confined to a particular location within the brain. Within that area distinctions of a particular kind are made. When any area "registers" an instance of what it has learned to recognize, it may make its information available to other areas of the brain in the form of a conscious feeling, sensation, or awareness. Even more often, information is passed around the brain without passing into conscious awareness.

Many of the centers in the brain have evolved to take on specific tasks, but much of the neocortex, the most recently evolved part of the brain, seems more general purpose than older areas of the brain. However, even this part of the brain takes on specific functions that are then localized within it. Different people seem to train different areas to do different things. For example, dyslexia may be nothing more than training the wrong mixture of areas to perform the tasks associated with reading. Some tasks are critically dependent on timing. If the centers that take on these tasks are not coupled properly, they may be unable to adjust. If so, it may prove very difficult, perhaps impossible, to back out and realign the brain centers allocated to the task. The brain does seem to have some flexibility. Some cases of brain trauma, resulting in lost skills, have been partially overcome.

It appears as if each cognitive area almost has an identity of its own. Sometimes the communication between areas is not as effective as it should be. Answers to problems have been known to pop out in dreams. The mind is a collection of connected but semi-independent entities. Most of us train these entities to work together and in harmony, but not everyone succeeds at this. There have been cases of multiple personalities that appear to be completely unaware of each other's existence within a single brain.

The individual differences in mental **potential** between people are probably on the same order as our physical differences, but as the mind develops its potential it locks in its "program." It assigns areas that can later change very little. What any mind can achieve, most minds could have **approached**. However, after the mind is mature, it is common to find individual differences of orders of magnitude in particular **skills**. A skill is much different than physical ability, it involves the **mind**. One person is seldom more than a few times as **strong** as another. One person can seldom **hear** or **see** more than a few times more clearly than another. But, some people easily perform a physical or mental **skill** a thousand times better than average. Of course, it takes years of practice!

A chess master can look at a chess board with a couple of dozen pieces in the middle of a game and, in a glance, remember each piece and where it is on the board. These and other feats are done by learning and practicing a repertoire or vocabulary of patterns that symbolize meaning to us. We can even learn to observe and be aware of the workings within our own minds. This type of learning can lead to some of our greatest potential strengths. But, the way our brains are put together also leads to certain weaknesses.

## Our Common Weaknesses

Evolution has equipped us with survival instincts and abilities that have been useful and necessary over our entire evolutionary history. We share many of our abilities with our closer primate relatives and some with almost every other living thing on earth. However, a few of our traits and abilities are unique with us. These have evolved only in the past million years or less. Our culture has changed a lot in the past several thousand years, but not our basic DNA. Our physical nature and abilities have changed very little for tens of thousands of years.

Most of our unique abilities stem from our larger brains, but ours are not the largest brains on earth. Elephants, whales, and porpoises have larger brains. Neanderthals may have had them too. Our ancestors, whose brains were as capable as ours, probably didn't use them as we do. We have developed virtuoso violinists, acrobats, ice skaters, tennis players, downhill skiers, chemists, computer hackers, and hundreds of other niche players each of whom can do with excellence that which the rest of us can hardly do at all. The only preparation evolution could have given us for these activities is our

relatively large brains. They appear to be general purpose in nature, rather than specialized for some particular ability, or programmed for a single environment.

But this is not completely so. We **are** specialized in certain ways, and our general abilities **do** have limits. Yes, we should test those limits. We should never quit without trying, but it's a fact that thousands of people are world class at one thing and almost no one is world class at two or three very different things. There have been idiot savants that could perform miraculous mental feats but who were virtually dysfunctional in normal everyday life.

Many of our common weaknesses would be strengths if circumstances were different. These weaknesses are often part of "automatic" behavior. If we know them and can recognize when they come into play, we can better avoid being "blindsided" by them. The list that follows is not complete, but some of the most critical behaviors to understand and watch out for are included: Taking a shortcut, following a leader, attending to novelty, reacting to scarcity, induced cooperation, foolish consistency, and "the easy sell."

## Taking a Shortcut

We take shortcuts because they save time and energy. Thought takes both of these. Sometimes we need to take action quickly or without thinking. In those cases we resort to reflex and heuristics. A *heuristic* is a rule-of-thumb that makes a decision easier. Most of our reflexes and some of our heuristics have evolved over the course of millennia, due to the experiences of our ancient ancestors. The remainder we have learned, either through our own experiences or because they were taught to us.

Taking a shortcut consists of two parts: The stimulus and the response. The stimulus may be anything from a tap on our kneecap to a complex pattern of events in the world. Our response may be anything from a knee jerk to an involved sequence of actions that could take half a lifetime to master.

It is important to build up a repertoire of reflexes and heuristics. They often permit the most effective and accurate responses to the situations that may confront us. When we can afford the time and effort, it is always better to think before acting, but even then we will often fall back on an appropriate and well-learned response.

Here, instead of going into how we can develop more and better shortcuts, we will look at some examples of shortcuts that can lead us into unexpected trouble.

Prejudice is a word used to describe a whole class of shortcuts that are often inappropriate. We have a strong tendency to stereotype almost everything. This isn't necessarily bad, it's an important part of developing effective shortcuts. We have evolved a truly extraordinary ability to form stereotypes. However, it's very important to develop accurate stereotypes, effective responses, and the ability to use them only when appropriate.

When our stereotype involves a whole group of people, a religious or political ideology, or a complex set of behaviors, a stereotype is nearly always inappropriate. It develops on the basis of incomplete (or even wrong) information. Even though stereotypes are an attempt to simplify a complex pattern, some patterns are **too** complex. When an area can't be effectively stereotyped, it also can't be reacted to effectively with programmed responses.

Even simple and sometimes appropriate stereotypes can lead to trouble. The following simple stereotypes may be accurate, but are they cases where we can justify taking a shortcut instead of doing a little extra thinking?

> You get what you pay for.
> If an expert said it, it must be true.
> They wouldn't print it if it weren't true.
> Four out of five doctors recommend it, so it must be good.

Imagine you are confronted by whichever of the following appeals to you the most, a tall, dark, and handsome man or a slim, articulate, and beautiful woman. This stranger smiles and asks something of you. The chances are you will comply without thinking, just because of the stereotype they fit into. Try to catch yourself reacting on the basis of stereotypes.

## Following a Leader

Both tradition and authority are cornerstones of our society. And, yet both have been the cause of profound mistakes in the past. The tendency we have inherited, perhaps genetically, to follow a leader cannot be criticized — it simply is. But, we should examine this tendency as often as we can.

Tradition and authority are natural enemies of the creative process, but not necessarily of creative people. This is a little like fire. Fire can be very beneficial, but you have to be careful with it, or you can get burned.

It is just as wrong to stereotype leaders, tradition, and authority, and react **against** them, as it is to always comply without thought.

## Attending to Novelty

The nervous systems of all animals have evolved two fundamental abilities. One is the ability to recognize certain levels of change in their environment, and the other is the ability to accommodate to almost anything that is repeated often and regularly enough. These are basic survival skills. We register on the novel and then ignore it when it becomes routine.

The success of tabloid newspapers is an example of how our fixation on novelty is inappropriate if we consider them a source of news and not just mindless entertainment. Much of the "news" we get from more respectable sources is also just entertainment. There are many critical issues that change very slowly.

> Put a frog into a pan and put the pan on a hot stove. When the frog feels the heat it will jump out of the pan. Now, put a frog into a pan with some nice warm water. Put the pan on low heat. The frog has the ability to jump out of the pan, but it only attends to novelty. There is no moment of significant change, no point when its tabloid nervous system sends it a headline: **You're about to die!** So, it gets cooked alive.

We ought to be smarter than a frog, but it takes a little thinking to sort out necessary information from pure entertainment. Novelty and change will always command our attention, but we can choose what we seek out. Sometimes, slow change is important, as may be events that will never come to our attention if we don't seek them out.

## Reacting to Scarcity

Every one of us, no matter how thin or how rich, has a deeply ingrained reaction to the news that something is scarce. If it's scarce, we want it. If there's a long line, we have an urge to stand in it because there must be something desirable and in short supply at the head of it (like a few remaining seats in a restaurant or movie theater). This isn't too hard to understand in a species that has survived as many ice ages as we have. But it's something we need to observe in ourselves. In modern society it is seldom the case that our lives are threatened by our failure to grab the first goody at a garage sale. Often, with no need at all for a thing, just believing that it's scarce is enough to make us want it. We are easily manipulated in this way. When you learn to see this happening, you can laugh at it instead of having every hint of scarcity take control of you.

## Induced Cooperation

Cooperation is another deeply ingrained reaction. There are certain people you learn to cooperate with automatically. That's okay. But, when someone sets themselves up to fit the pattern of people you automatically cooperate with, then asks you to cooperate, you are likely to do so without thinking. That's not okay. That's simply manipulation on their part, and unthinking reflex on yours.

People automatically cooperate with authorities, with people they respect or admire, and with people they identify with: Attractive, friendly, and articulate people.

When someone wants your cooperation, simply observe the situation. Is your urge to cooperate (or withhold cooperation) based on the presence (or opposite) of one of these patterns? If so, think about it. Are you being manipulated? Is cooperation in your own best interest, or does it go against your interests? Are you facing a salesman? A con man? Or, someone who really deserves your help?

## Foolish Consistency

Foolish consistency may be the "hobgoblin of little minds," but consistency is one of the primary strategies of learning. When something works once, it's likely to work again. We strive very hard for consistency. The quirky little rituals that professional athletes repeat, like their serves in tennis, are not foolish, they are often a vital part of their success. We are also taught "to thine own self be true." Again, the usually good advice is to be consistent.

So, how can consistency be foolish? It's foolish when it's not appropriate. Circumstances change. A judge who awards every first offender of burglary a three year sentence, a teacher who has a point scheme counting up every facet of his course and who awards a grade without looking beyond that total, both are ignoring all but a small part of what they should be trying to measure.

Our tendency to be consistent works against us most often when we aren't paying attention. Often our bad judgement is engineered by someone else, a salesman perhaps, who is trying to cause exactly that bad judgement. This often starts with simple questions whose answers are obvious. Then it works up to the zinger. We are trapped into giving the answer the salesman wants in order to be consistent with all of our previous answers.

> The street vendor confronts you around noon. He asks: Are you hungry? Yes. Can you afford $5 for lunch? Well, yes, but I hadn't planned to eat that much. Well, try one of my very tasty

> Fatfurters, you'll love it! I'll even throw in a drink for free. He holds out the Fatfurter. Here, hold this. Now, what would you like for your free drink?

Most of us like to say yes more than we like saying no. Of course we like things that are free. We've already said we can afford it, and that we are hungry. Here we are even holding the thing so that he can pour our drink. How can you possibly be consistent without paying the $5 and wandering off munching your Fatfurter?

## The "Easy Sell"

A profile of the modern western life: 33% sleeping, 22% working, 10% watching television, 10% shopping and "wandering the mall," 10% on the road, 10% dining, and 5% "quality time." Not a pretty picture, but that's beside the point for now. The common theme here, except for when we're sleeping, is that every one of our activities constantly puts us in touch with some form of sales encounter.

Even when we're driving in our cars, we see billboards, hear radio commercials, and read bumper stickers. When we aren't being sold something, we are trying to sell someone else. Our educational system teaches us a lot of things, but almost all of us can go right through it and never encounter a course in salesmanship or in how to protect oneself from sales techniques. And yet, successful people in modern society are almost always effective salespeople.

Let's do another thought exercise and divide people up into good, average, and poor salesmen versus their being hard, average, and easy "sells." This gives us nine categories, like a tic-tac-toe grid where average is in the center. Sales ability will be from bottom to top (highest ability along the top). Sales resistance will be from left to right (highest resistance at the right).

The less fortunate people in the world are located at the lower left of this square. They have lowest sales **ability** and least ability to **resist** the sales pressures of others. They are easy prey, and are able to take only what falls into their hands by accident. Some of the more fortunate people in the world are at the top, center of the grid. They have the well developed skill to sell themselves and their products or ideas to others, but their ability to resist the sales pressure of others is neither too weak nor too strong.

Ask yourself, where are you located in this scheme? What can you do to move more toward the top of the middle column? It's worth thinking about on a regular basis.

## Making Accurate Judgements

The most difficult judgements are made on the basis of insufficient data. Even when we have all the facts, sometimes a decision is still difficult to make. A large part of the difficulty comes from the weaknesses we have just been discussing. Let's follow a series of simple, but tricky, situations and see how our weaknesses might lead us to the wrong decision and what we can do about it.

1. Would you rather draw straws, where a single short straw says you get nothing and four long straws all say you get $100, or simply take a sure $75?

Simple arithmetic would say that the expected return for drawing straws is $80 (four chances of $100 plus one chance of nothing, is a total of $400 divided by 5). $80 is better than $75, isn't it? Or, is the $5 difference too small to justify taking the risk? What if the difference were larger? What if you had four chances out of five to get $1000? Would you prefer that to a sure $75?

The fact is that, we don't always decide on the basis of cold mathematics. Studies have shown that when we are in a good mood, we are more optimistic, and vice versa. Some people always prefer to avoid risks and other people often prefer to take them.

How consistent are you when you make decisions like this? How at peace are you with yourself afterwards? If you can always walk away without looking back, perhaps you should play the odds. If you are going to deeply regret passing up the $75 if you lose the luck of the draw, then the extra $5 probably isn't worth the anguish.

Does it affect you if others are involved? What if this arrangement were offered to you with a couple of friends? Suppose the friends decided to gamble and draw straws. Would you be comfortable drawing against them? Would the competition affect your decision? The "right answer" is to develop a consistent approach that you feel most comfortable with. Objectively, the more this approach logically considers the facts and the probabilities, the better.

2. Which would you prefer? A sure loss of $75, or an 80% chance of losing $100 coupled with a 20% chance of losing nothing?

Logic tells us that this is just the opposite of the above. Logic tells us to take the sure $75 loss, but emotion might tell us to gamble on not losing anything. However, if we gamble, we can expect to lose $80 on the average. In both cases, there is a $5 spread. How small a spread, in either scenario, does it take for you to accept or go against the logic of the situation? Above, logic says to take the gamble. In this example, logic tells us to take the sure thing. Think about this for a while. It may tell you whether you are a risk seeker, or risk averse.

3. Which should the average person fear most in the United States? A loved one being murdered, or a loved one committing suicide?

How might this affect your decision to keep a gun on hand? If you wanted to protect yourself and your loved ones, you might very well believe that a handgun would help. However, statistics say that 30% more deaths result from suicide than from homicide, and they also show that guns are more likely to be used against a family member than against an outsider. Given the statistics, which is in our better interests? To insist on our right to own a gun, or give up that right in order to keep them out of the hands of others?

4. Which causes more deaths in the United States? All types of accidents, or cardiovascular disease?

Accidents stand out in our minds. They are much more likely to be reported in the nightly news or the morning paper. And, they strike the young and the old alike. So, when we sample our memory to try to determine the odds, we can probably think of far more accident than heart attack victims. But in fact, **ten times** as many people die from cardiovascular disease as from all types of accidents.

5. A family has six children, three boys and three girls. In which order were they most likely born? BBBGGG or GBBGBG.

Did you examine these two alternatives and conclude that the first was a regular pattern, and therefore less likely, while the second followed a random pattern, and therefore more likely? If so, you fell into the trap. Any sequence is just as likely as any other.

In fact, if it had not been stated that there were three boys and three girls, the sequence GGGGGG would be as likely as BGBGGB.

6. In a standard English dictionary, does the letter k appear more often as the first letter of a word, or as the third letter?

This is one of the most famous and instructive examples of all. We tend to be able to recall words that start with a particular letter much better than ones with a letter in some other position. What we can quickly and easily recall tends to form our "statistical sample" and leads to our estimate of the probabilities. Our recall is more affected by recent news than long term experience, by moods more than knowledge, and by heuristics and shortcuts more than logic and calculation. It turns out that three times as many words have k as the third letter than begin with it! Most people would judge it the other way around.

7. According to a survey, there are 123 truck drivers and 16 professors of anthropology in a particular college town. Consider Arthur. He was picked for this survey at random. You have the following facts: He is bald, slim, writes poetry, and enjoys working in his garden. Question: Is Arthur a truck driver or an anthropologist?

Of course, with these facts you can't be sure, but take a guess. Does Arthur fit your stereotype of an anthropologist or a truck driver? Did this line of thinking even cross your mind? It would cross the minds of most of us. Here we have some background data and some foreground data. In the background there is the fact that any person chosen at random from this group, consisting of truck drivers and anthropologists, is much more likely to be a truck driver (123 chances out of 139).

In the foreground, where all of our attention is concentrated, we ask ourselves is Arthur the name of a truck driver? Not likely. Do anthropologists like to dig? Of course. A bald, slim, poetic truck driver? Or, a bald, slim, poetic anthropologist? Has to be an anthropologist.

But, the separation into foreground and background is purely a trick of our mind. It doesn't separate the facts. Arthur's case history is about as neutral as it could be with respect to occupation. It might form more easily into a prototype of an anthropologist than a truck driver, but is this because it describes a small minority of people? Or because truck drivers are fundamentally less likely to write poetry than anthropologists? In this case, what we see in the foreground is almost completely unrelated to the question.

Therefore, assuming the specific information has little bearing, the odds of Arthur's being a truck driver are fairly close to the sample sizes, 123 chances out of 139. Arthur is probably a truck driver.

8. Two hundred women were surveyed: 180 were housewives and 20 were corporate lawyers. Joan, selected at random from among these women, is known to be a very strong advocate of women's rights. Is Joan more likely to be a housewife or a corporate lawyer?

Again you are asked to make a choice based on some sampling data and some specific information. Our tendency is always to give too much weight to specific facts and not enough to basic probabilities. How does the fact that Joan is an advocate of women's rights change the odds? If 9 out of 10 women lawyers were strong advocates of women's rights and only 1 out of 10 housewives were, then it would be a toss up as to whether Joan is a lawyer. Without strong proof to the contrary, it is most unlikely that these two groups of women would be so different. Therefore, Joan is more likely to be a housewife.

* * * * *

It has been documented that right after an earthquake there is a sharp increase in demand for earthquake insurance. For a time, there is also a greater likelihood that another earthquake will occur.

How do “risk averse” insurance companies react? At least some of them refuse to sell earthquake insurance for several months after an earthquake, because of the “greater” risk. By this time, they have lost the effects of the greater demand. These companies are in the business of assessing risks, passing the costs of them on to their customers, and selling as many policies as possible. The more policies the more profit and the closer their actual losses should approach their calculations.

Many decisions are made in just these scenarios. Sometimes the underlying probabilities may be difficult to estimate, may need to be gathered, or may not exist. If they are available, they should be accurately assessed and given their full due. Always guard against using or interpreting data falsely, especially when it comes from your own memory or “gut” feeling (like estimating occurrences of the letter k).

When specific information is present, as it usually will be, be careful not to give it undue weight. Consider if and how it changes the basic probabilities. Sometimes, the probability data may be missing or unreliable. Other times, the specific information is hard to interpret or relate. In these cases, construct alternate scenarios. Ask yourself if the specific information is accurate and relevant. Or, is it only someone’s guess or prediction?

Once you have reached a decision based on the information you have, ask yourself how the situation would have to change in order for you to change your decision. You might find other scenarios, some perhaps as likely as the original one, that would lead you to a different conclusion. If so, your decision needs a different basis, or your basis needs a different decision.

When the data still leave you in doubt, you need more information. Information costs time and money to gather. Before seeking answers, ask yourself how you will use them. If you had the answer to a particular question, would it change anything? Often, the answer is no. We are a curious animal. We seek information sometimes for its own sake. This is fine for entertainment, but when you must spend scarce resources, you can’t afford to waste them. So, be sure you know **how to use** an answer before asking an expensive question.

> A man was once exposed to carbon monoxide poisoning. A few hours after exposure the man went to sleep for the night. The next morning symptoms were quite evident: Severe headache, nausea, and vomiting. Several more hours passed and the symptoms were lessening. Having resisted it at first, the man finally allowed himself to be placed into medical care. The doctor had him begin breathing pure oxygen. After several hours with no further sign of the symptoms, the doctor requested a blood sample to be sent in for analysis. This procedure would cost only $75. It would document the level of carbon monoxide in the man’s blood and place data into his record. “But, what effect would it have on treatment?” the man asked. “None. There really isn’t any further cost effective treatment that I can give you, but I would really like to make this data part of your record,” the doctor replied. The patient, after thinking about it in those terms, declined to give the sample and pay the extra $75.

## Self Control

Where does self control come from? Does it reside in a particular area of the brain? It seems to us that we are in control of most of our voluntary behavior. We are each of us reasoning creatures. We may act from emotion, habit, or from studied thought. But, when we think about it, we can almost always find a **reason** for the way we have behaved. This “reason” is often, perhaps always, just self rationalization.

Recent evidence has shown that control over ourselves doesn't work the way we thought it did. The following two examples are intended to cast some doubt on our so-called "rational processes."

The first example comes from an experiment that taps an electrode into the brain. This electrode monitors the nerves responsible for the movement of some part of the body under voluntary control. The experiment is set up to measure the latency, the delay time, between the moment we feel that we have initiated a movement and the nerve activity that drives the movement. The surprising result is that when we report initiating a movement, it is generally about one-half a second **after** the nerves have signaled the activity. It's not clear where the decision comes from, but our sensation of "doing it" is only a delayed observation of something else that may, or may not, somehow stem from our will.

The second example involves flashing lights. It is well known that if two lights are spaced a small distance apart, let's say about a foot apart and about 20 feet away, that the eye can be fooled by them. If the first light is on, then goes off, and the second light comes on a very short time afterwards, it looks to us like motion. We think the light has simply moved from its first location to the second. This isn't too surprising. But, suppose the first light is red and the second light is green. Now it looks like the light moves and changes color. Again, not really too surprising. But, think about it. The light seems to change color at exactly half way between the two points. This means that the light looks green to us **before** the green light has come on! The only other explanation, and probably part of the true explanation, is that the whole sequence happens before we really perceive it. Our perceptions are a kind of integrated replay of the raw information gathered by our sensations. It would appear that both our reactions and our data gathering happen before our awareness of them is felt.

Does this mean that our existence is a little like watching a ball game on a channel with a delayed signal? Yes, and no. We know that many of the workings of the brain are not directly experienced. We also believe that there is not just one, but many brain centers, that contribute to conscious experience. Clearly, conscious and unconscious (sensed and unsensed) activity in the brain works together to produce our perceptions and our voluntary behavior. It may startle us to discover that what feels like a conscious decision to act is only a delayed sensation of that action having already been initiated by an unsensed process. It seems reasonable to believe, however, that we **do have some** conscious part in the process. Maybe it should even **comfort** us that our mind is always about a half-second ahead of where we think we are.

## Our Basic Drives

On a molecular level we have mechanisms that control and drive our behavior (chemicals, or drugs, that affect the firing of our neurons). On a system level we have "autonomic responses" that take charge of our behavior. At the highest levels, there are patterns of behavior that connect throughout our entire lives. Our "basic drives" are an important part of this behavior. Basic drives are those for which special neural machinery develops. Our drives to obtain air, water, food, sleep, and sex have at least some machinery that is genetically determined. Other drives, such as the drive to "succeed" and the drive to "be admired" are built on the basis of more general machinery. However, no drive is all of one and none of the other (we use words like "reflex" and "autonomic response" for behaviors that are purely genetic).

Drives form part of our basic nature. We have to account for and integrate our natures, not try to override them, suppress them, or deny them.

It's not completely clear, except for the amount of learning required, how to draw the line between what we call the "instincts" of animals and the "drives" of humans. If there is a difference, perhaps it's the degree to which instinctive behavior is so well circumscribed and "driven" behavior is so variable.

The machinery for different drives is largely put into place during a few specific years sometime in the course of growing up. This is true also for most of our more complex abilities and perceptions. There is a genetically determined point in time when certain neural foundations are laid down. Many things can be learned later in life, but only on the basis of circuitry that is developed at a given critical time from a few months before birth to about 16 years afterwards. Each person's experiences are different during these critical periods of development. This is one reason why the same drives result in different behavior in different people.

The second way that a "driven" behavior can differ is on the basis of pure underlying mechanism. Everyone develops differently because of genetic differences and the vagaries of growth and maturation. Even identical twins develop a few physical and mental differences.

The third way that all of our behavior patterns become different from one another's is through learning. Learning teaches us to amplify and suppress, for one reason or another. No two people have the same history of learning. Learning also teaches us a repertoire of behavior or "an outlet" that we associate with each of the drives we develop.

This is perhaps the source of the biggest differences between our various "driven" behaviors. We are all driven to breathe, but we can hyperventilate or hold our breath. We all have to eat, but some of us develop the eating disorders of bulimia (gorging to the point of throwing up) or anorexia (under eating by thin people who have an irrational fear of being fat).

It begins to sound like we don't have any choice in these matters. If a drive gets out of whack or emotions cause our behavior to run wild, it's not our fault, it's a product of our genetics and our environment, right? Maybe. But if so, so what? Each of us bears the greatest burden of our own shortcomings. Other people may choose to help us out, or simply move out of our way. The more we think we deserve a helping hand, the more dependent on it we may become. Society may give (handicapped parking spaces, for example), or it may take away (county "poorhouses" for the homeless). It comes down to the inescapable fact that each of us has to live with our self no matter whom we blame for our "opportunities missed" and how we "turned out."

Actually, you **can** do something about drives that are out of whack, or about emotions that are counterproductive. You can develop an ability at almost any stage of life (the earlier, the better of course) to "stand outside yourself" and look at what you are doing, thinking, or feeling. You can do this whenever you feel bad, or you can make an almost continuous habit of it. The more you do it, the more you will learn to be objective when you're doing it, and the more your "reflex" behavior will be subjected to your own scrutiny.

For example, you are confronted by another person's extremely rude behavior. You might react with some rude behavior of your own and get into a fight, or worse, a lawsuit. How would you feel if you were watching two others in this situation? You could side with one or the other, and jump into the fray. But, more likely, you might be happy not to be involved, and stay out of it. As an observer of yourself, you can more easily get perspective in the midst of a confrontation and make a sensible decision to defuse it, or even walk away from it.

In the heat of the moment, it's really hard to think of the perfect put-down. It's also easier to give advice than to take it at times like those. But, by putting yourself in the role of an observer, you get some distance from the situation, you get some objectivity about it, and you get all the advantages that an observer has over someone whose drives and emotions are in control of their behavior. You get a little bit of the benefit of 20/20 hindsight.

Opening up a place in your mind to observe yourself is just as important when you're alone as it is in the heat of the moment with someone else. When some nagging thought or feeling is going around in your mind and you wish it would stop, all you usually have to do is just observe yourself. Instead of counting the ways that so and so is an idiot, just observe the thought going round in your head. No state of mind can retain control of you when you take a mental step back to see both yourself and your thoughts together.

Learning to observe yourself at all is the first step. Making it a habit is a bit harder. But, to become truly effective, you need the knowledge to be objective and put various situations in perspective. Some of that knowledge is contained here. The key to wisdom is putting knowledge to use and making it a complete part of one's self. This takes emulation and practice. And since you can't emulate a book, you have to find role models in the form of other people.

## Sex and Violence

If we didn't have two genders, the topic of sex would not even arise. In fact, it is likely that the topic of violence might also be far less important. But, we do. And so, this field is ploughed up here to find out what we can unearth to learn about ourselves.

To survive as a species, and to flourish as we have, all humans have very strong propensities for sex and violence. We feel the emotions of greed, envy, lust, jealousy, and a variety of others, all related to our drives to control others and satisfy ourselves. Individuals feel these emotions to different degrees, at different times, and due to different triggers. Here, I will attempt to remove the emotion from the discussion of two very strong emotions.

Sexual behavior could be defined as any behavior that is **fundamentally** different between males and females. It mighty be extended to behavior that is **slightly** different, but we will discuss that aspect of sexual behavior later.

Sexual behavior may involve only one's self or other consenting individuals, but indirectly it concerns the entire species. This is why many people link it with religion and morality. However, the only way that the effects of any kind of sexual practice, occurring between people in private, can affect society in general is over a very long time, and in terms of numbers of offspring and their characteristics. Society at large (in a world threatened by overpopulation) might have a legitimate demand on individuals to **limit** their numbers of offspring. But, in today's world, society has no other legitimate demands that relate to the sexual practices of individuals, unless others are directly affected in a way they don't wish to be affected.

Every aspect of a female body and brain has a counterpart in the male. The difference between male and female is the degree to which the development of many parts is different. Differences in the brain might be subtle, but they exist. The development of muscle and fat over the body is different in many places, and to different degrees. The most obvious difference is the way that a clitoris, uterus, and ovaries in the female have morphed into a penis, scrotum, and testes in the male.

Every part of the body develops slightly differently between any two people. The development of height, weight, and intelligence over a large sample of people results in measurements that lie on a normal curve. The differences in sexual dimorphism (and this includes details hidden in the brain) also lie on normal curves. That means that some characteristics may actually cross over, such that a man or a woman might develop a characteristic associated with the opposite sex more than some of other sex has developed it.

What evolution has done to us is make sure that these differences are put into play in such a way that the maximum number of offspring are produced. And, therein lies the rub! Anything that nature could come up with, that gets one additional sperm in contact with one additional egg, is a possibility that we should expect to find within ourselves.

Males range all the way from passive personalities to aggressive personalities. But the average male is more **aggressive** than the average female. In light of the above observations, it's not hard to figure out why. With aggressive males and passive females, that sperm gets to where nature intends it. Teenage males probably think about sex hundreds of times a day. They probably have erections dozens of times a day. This falls off into their 20's and 30's, but thoughts of sex and a feeble erection could easily be the final moment of any 90-year-old man.

Since this subject has been poorly researched (or I simply haven't done the research), and since I'm a man, I don't know what paragraph to juxtapose with the above for females. Given the pain and suffering involved, a lot more of them turn up pregnant than could be explained by rational thought, so there must be some strong urges involved or their side as well.

One thing I know for sure, as a man, is that when it comes to sex, "no" is almost not even present in a man's vocabulary. When a woman says "no" to a sexual advance, it may come at many different points. The first point is in a social setting with clothes on. The next could be in private with clothes on. Then comes touching, first with clothes on, then with some clothes removed. After the stage of touching, with all impeding clothing removed, come the points of insertion, the moment before the man's first sperms are emitted, and then his full ejaculation. Each point along this path is a point where the female "no" is less likely to be effective, and less likely to turn the sex act into rape.

Rape could be defined in various ways, but if it is defined as sperm enters vagina after "no" has been spoken, can it actually occur after some of the latter points in the above sequence? Which points?

Of course, age is also a factor. The very fact that a female is under a certain age constitutes one element of rape, but if this fact is not known or apparent to the male, can it be called rape? The prototype for rape should be whether violence is involved, and the degree of violence. It seems to me that rape, and whether sex is consensual or not, are acts that lie on a continuum. Unfortunately, our identification and treatment of acts of rape is inconsistent. The advice here is that the short term gratification offered by sex can be completely wiped out by its long term consequences. You need to consider all possible long term consequences before crossing each of the lines in the act of sex.

The range of behaviors involving sex and violence are well known to us all. In fact, everyone of us is fairly well acquainted with our own responses in these areas to various situations that arise. But, how did we turn out the way we did? Our brain centers were not programmed at birth to make us this way. They were, however, **ready** to be programmed. This programming occurs in the first few years of life (probably after 18 months and before the age of 4 or 5). The process involved is like "imprinting." This is a term that describes the attachment birds form with any object that interacts with them in the early

days of their lives. Once imprinting is initiated, it develops from there, and it affects more and more of our behavior that involves sex and violence.

Behavior at the median of a normal curve is typically called “normal.” Behavior at the extremes of a normal curve is sometimes called abnormal (or deviant, or perverted). As political correctness comes to accept certain traits at the extremes of their normal curve, we drop those terms and adopt another, or politely ignore the trait altogether. It occurs to me that *pederasty* is a deviant trait that results from the same imprinting process that others go through with a completely different outcome. The same might be true for wife beaters, and the extremely violent. In these cases the very nature of the adult in question is just as fixed as the nature of a homosexual or any “normal” heterosexual. Most of us are not obligated to change our “true” natures very much. Lucky us. But all of us have a nature that we need to **control** to some degree. A few of us, have **special** needs. Some of us need to raise our input sensitivity threshold, and some of us need to lower the volume on our response output. These changes to our behavior won’t give us immediate gratification, but they will enhance our long term success.

Neither sex nor violence is called for when it is not consensual. When either is consensual, it is very likely to occur. Even so, there may be **severe** negative consequences. Violence must not be allowed to go too far. The easiest way to prevent this is to draw the line at the very beginning. Obviously, the negative consequences of violence are that somebody gets hurt or killed. The negative consequences of sex should also be borne in mind. The most obvious one is that a new life may be started, and the lives of those involved will radically change. Another is that an STD (sexually transmitted disease) might be exchanged. A lesser known result of vigorous sex is Peyronie's disease (look it up).

## Moral Development

Morals and ethics are discussed at more length in Chapter 6, and the process of growing up is covered in Chapter 5. Moral development is a product of both of these. It is discussed here because it depends upon self control and an understanding of how one fits into the scheme of things.

> The original purpose of self control is so that one does not **need** self control.

**Human** behavior passes through several stages before the term **moral** behavior applies. Psychologists and social scientists have defined different sequences of stages to describe this development. Some have used four stages, others six. I will not refer to them here. Instead, I will define a two-phased model. The first phase does have a sequence of three “stages.” The second phase has more like three possibilities. Some people may progress through one, two, or all three of these, just as though they were stages, but many people gravitate into just one “compartment” and stay there.

In Phase I, behavior is driven by *pleasure* and *pain*. In the first **stage** of Phase I, behavior is driven by the immediate feedback of pain or gratification, or after one or two encounters with various sources of these, it is driven by **fear** or **anticipation**.

The second stage of Phase I is reached when you realize that other people hold many of the keys to your *reward*s or *punishment*. These are your *authority* figures. They may ask or expect certain behavior of you, and you comply because this has led in the past to pleasure and gratification. You also know that non-compliance can lead to pain or discomfort. You learn to select your own behavior on the basis of how you think your authority figures will judge it.

The third stage of Phase I involves an understanding of rules. Rules may be adopted amongst peers, or they may be handed down by authority figures. In either case, you no longer obey authorities directly

just because they hand out rewards and punishment; now you obey the rules. The connection between following or breaking the rules, and satisfaction or discontent, is more complex than the previous stage, but it is generally learned by all of us.

Of course, we never outgrow any of these controls over our behavior. Pain is always effective, and authorities always have the carrot and stick to fall back on when we fail to comply. But, when most of our behavior **considers** rules (whether we follow them or not), we are ready to graduate from Phase I.

The next phase consists of two dead ends and a never-ending path. It has to do with the questions, "Where do the rules ultimately come from?" Do the rules have any ultimate importance? Although, the first two "stages" of Phase II, can become dead ends, some people may grow through them, and other people might even skip over them.

The first stage in this phase is to acquire as complete a knowledge as possible (not quite the same thing as an understanding!), of all the rules and laws that play a part in the control of behavior and the delivery of rewards and punishments. You may work out your own behavior patterns on the basis of the odds of not getting caught, for example. In this stage, right and wrong are not really effective concepts. Rules can change. "Right" relates to the rules at the moment. "Wrong" has more to do with getting caught than anything else. This is sort of the "lawyer" stage. Again, it might be entered and perfected, passed through, or even skipped over. Some of the best lawyers **and** criminals remain in this stage and work to perfect it.

The next stage is the "priest" stage. In this stage two concepts are developed that never become quite clear in the previous stage. The first is that ethics, based on morals, along with rules and laws, are also a legitimate part of the framework that we have to use to guide our behavior. The second notion is that there is some higher source of all these rules. Man's rules and laws may be made by man, but they should first be consistent with those from this higher source. A consistent set of morals and commandments exists, and it is man's duty to learn and follow them. This higher source may be God, or the common good of all humanity, or even Nature.

The final stage of moral development comes about when rules, laws, and ethics are actually understood. This is the stage referred to in the quote about "not needing self control." All of the external factors, at this point, have been incorporated into one's own make up and understanding. Behavior is determined by the entire complex that makes up one's personality, and part of this is an acceptance of frameworks that are made up of rules, laws, ethics, and other codes and standards of behavior that are learned over the years.

> Morality is the doctrine of how we earn the right to happiness.

Self control involves being in control of your own behavior and directing it to be consistent with who and what you **intend** to be. Much of our behavior relates to our drives. We tend to avoid pain and seek pleasure. We have evolved to do whatever will bring our bodies into a kind of balance, called homeostasis. We do have the ability to reason, whether we use it to rationalize our behavior after the fact, or learn to control our behavior rationally.

*Ethics* are the principles that spell out "good" or moral behavior. We will talk about them more later, because they have more to do with behavior that interacts with others. *Etiquette* is the set of principles that guides conventional behavior. Again, this pertains to behavior that affects, or may be observed by, others. Etiquette is socially accepted behavior, and it guides many situations that simply aren't addressed by ethics. The etiquette at one time and place may be quite different from that at another.

Etiquette, ethics, regulations, and laws are all rules. In a sense, they are all **languages**. The formal system of productions used to define a grammar, could be adapted to codify any of these systems.

Behavior names a whole class of sequential, meaningful, and patterned activity. Good, proper, intended, useful, healthy, acceptable, intelligent behavior names a subset of this class, behavior that we might wish to cultivate. The clarification to ourselves of what we **intend** to be, and whether our behavior is guided by our own self control **toward** that end, is a subject worth much introspection.

# IV. An Understanding of Others

Instruction manuals should be "read before assembly" (impossible in this case). But, they really make sense only when we can interact with the subject they discuss. Other people are the keys to our destiny. We cannot unlock the potential within ourselves by reading an instruction manual; we must seek out other people. Not only do others help us **achieve** our destiny, they take our **measure**.

Our society has evolved both laws and lesser rules. Laws relate to **formal** justice. Our lesser rules relate only to our **sense** of justice. A natural hierarchy exists: Reality supersedes the law, and laws supersede mere rules. This means that reality can ignore both the laws and rules of any group of people. But the reality **of** a group does include laws and rules; it just might not include them consistently, or in the same way that any of the individuals might think. Man's laws are **designed** to supersede his rules, but the reality is that the force of rules, especially unwritten codes of behavior, can often overwhelm an individual.

> Ignorance of the law is no excuse; if it were, it would be every man's excuse, and there would be no refuting it.

All people are supposed to be held **equal** before the **law** according to our system of justice. But, it's a mistake to assume that this principle applies to other **rules** of man, or to any given **reality**. People's realities are different, and different rules may apply.

For example, rules grant certain privileges unequally. We've all heard that "driving is not a right, it's a privilege." Some earn the right to exercise that privilege, others lose the right. We allow doctors the privilege of prescribing medicine and of parking in no parking zones. We regulate who can operate an airplane and how fast people can drive on the highways. The police, of course, have the privilege of driving faster. These rules are called "regulations" and they are part of our laws, but the class of laws dealing with regulations seldom makes people equal.

Likewise people are not equal in reality. In reality, "might makes right." The golden rule applies: "He who **has** the gold, rules!" These are crude statements, but they have the flavor of reality and the ring of truth borne out by experience. The truth is that all men are not created equal, and that "equal rights" is an artificial concept that we try to apply to our system of justice, and hopefully to our sense of "fair play." If you can deal with these truths, you won't have any trouble coping with an occasional instance where you are "supposed" to be on **equal terms** with somebody. But, if the notion that life should be fair and that **people** should be equal is the basis of your philosophy, you are making yourself **needlessly vulnerable**. It's not a case of **should**, life **is not that way**.

The following passage seems to deal with **things**, but it's really more useful when dealing with **other people**, because this is what we find ourselves doing more than anything else when our patience, courage, or wisdom are being put to the test.

> God grant me the patience to accept the things I cannot change, the courage to change the things I can, and the wisdom to know the difference.

- The Serenity Prayer (paraphrased)
Reinhold Niebuhr, 1943

We deal with other people in four basic phases of our lives. The first phase is childhood and adolescence where we first learn about other people, play games with them, and have our first encounters of various kinds, including fights, friendships, and sex. The second phase is late adolescence and early adulthood. In this phase, we lay the foundations for the career and family that we will spend the rest of our lives building and raising. The third phase is the long term effort involved in pursuing careers, raising our families, and becoming more involved in the community. These tend to overlap, but they also follow a sequence. In this phase, some of us get involved in all of these activities, others in only one or two. Each of the major activities in adulthood ends at some point. When all begin to wind down, we enter the final phase of our lives, retirement.

The first phase of our life, growing up, is treated more in the next chapter. You have probably passed that phase, and are now watching out for insights to help you plan your way through adulthood. It is necessary to study and to know about people to be successful in finding a mate and a job. Having once found them, you must relate to your mate and other people in the workplace to develop a family and a career. This chapter focuses on the **differences** between people that can make it difficult, or, on the other hand, can be exploited, to find your way in the world.

## Earning a Living

"The first civilized pursuit is earning a living." To do this you have to seek your way in the world, and find a place in the social scheme of things. Let's take a look at some "schemes" that relate to earning a living. The first of these is a lesson in economics.

## Job Economics

One of the principles by which economies must operate to be strong and efficient is the theory of *comparative advantage*. Even though this principle is not generally recognized outside of economics, it holds a lesson for all of us.

In its economic form, the theory predicts the most efficient allocation of a country's productive energies when trading with other countries. Each of us must also decide how to allocate **our** productive energies, and our **jobs** form the basis for trading with other people.

Let's see how a simple case works in economics. Consider just two products each produced in two countries who could trade with one another. The first country (let's call it Highland) produces lumber more efficiently than milk. The second country (Lowland, of course) produces milk more efficiently than lumber. Now, suppose that Highland can produce both lumber **and** milk more efficiently than Lowland, and all of a sudden free trade opens up between them.

Several things could happen. First, they could refuse to trade. Both countries might go on making and consuming exactly what they need. Both milk and lumber would remain more expensive in Lowland in terms of other things. But, let's say they do begin trading, and that both countries keep making both products. Now, cheaper milk and lumber from Highland begins to enter Lowland's markets. Prices adjust to supply and demand.

After a while the Highlanders realize that their lumber barons are getting richer than their milk barons, and they begin to devote more productive capacity to lumber. This virtually wipes out the lumber business in Lowland, so that capacity is diverted to the production of milk. Eventually, as much capacity as possible will be shifted into lumber in Highland and into milk in Lowland.

All of the other possibilities are variations on this theme. No matter how they start off, if the two countries trade, they will shift resources toward this final picture if they wish to make the largest profits. Of course, here as in real life, productive capacity is not fungible. That is, you can't make lumber out of the same resources you use to make milk. In the long run fields can be turned back into forests, and there may be some flexibility. But in the short run it is better to **use** productive capacity than to let it stand idle. Over the long run, you can re-tool, raise different crops, retrain workers, and so forth.

When trade opens up between two countries, both can benefit by specialization and trade. In a community of many nations, each nation benefits if it can do these two things: First shift productive capacity into what it can most efficiently produce within its **own** set of skills and natural resources; and then enter into trade with other nations to the extent that each can complement the other. This principle explains why we find individual specialization going hand in hand with better technology, transportation, and free trade.

The theory of comparative advantage suggests what **you** should do as an individual with **your** time, energy, and ability. It states that the greatest total output occurs when each participant contributes what he does best. This should at least be a first approximation. Identify what your most productive assets are and compare them to each other, not to those of other people. You should do what you do best; you don't have to do it better than others. At the same time you should be aware of the "cultural environment" and interact with it to gain knowledge and maintain awareness in other areas.

The value of knowledge and awareness is often mentioned; it may be good to let one's interests range free. But specialization is important too. Economics proves this to be true. Specialization should involve finding what one does best and then focusing on that.

Economics also tells us about supply and demand. What you do best may be in low demand. You have to consider what your contribution is worth to others. It's more complicated, but not impossible, to balance what you do **best**, what you **like** to do, and what others are willing to **pay** you, with how much time you can afford to spend looking for a job, how far away you are willing to move, how well you can sell yourself, and how much you want to get paid. You might have to write these all down on paper and play around with them a bit to form a picture for yourself.

Once you **have** a job, **different** economics prevail. Ask yourself often, "Do you contribute more to daily profits and long term growth than you are being paid?" If so, you should seek a raise. If not, you should work harder, longer, or better. Or, you should expect one day soon to be looking for another job.

## Finding a Job

Finding a job requires balancing certain things and then selling them. You have to balance your education and experience, which dictate what you have to sell to a potential employer, with what you want and like to do, and both of those with what you can expect to get paid.

Several things are important to note and understand. While you are unemployed, your job is to find a job. That is a very specialized occupation and one that is thrust upon most people at one time or another in their lives. It's such a full time effort, that it's very hard to do it right when you already **have** a

job. Even so, if you have a job and you want to change jobs, the best advice is to work your **current** job full time, and only **moonlight** at finding another job.

You must identify your target market (potential employer), find out how to reach them, know what they want, and communicate to them how you can satisfy their needs and objectives. Another thing you should do is take advantage of all the sources available that can help you find a job. Ask around. Some are free, others may cost your future employer a fee. Try to keep your own costs, and the risks you take, to a minimum.

Before you can make a concerted and focused effort, you need a specific goal. Ask yourself: What different jobs can you do? Which are the highest paying? Which do you enjoy the most? Are you willing to relocate? Will a prospective employer pay for your travel to an interview? It helps to write these things down. Try to organize your priorities and make an action plan that is focused on a single goal. If that objective proves to be unobtainable, move on to a second objective. Be sure that you give some priority to each viable contact. Get as many "irons in the fire" as you can, but never neglect a "warm prospect."

## Dealing with Other People

Most interactions with other people follow a "script." Unwritten, but well learned, rules of behavior apply. Whether you have a "well learned script" or not, you should keep in mind that each party in a personal interaction **wants** something. If you know your needs and those of the other person, you can work out a way for both of you to win. If you don't know what needs exist, find out. Especially find out your own needs. Chauvinism, insecurity, and the need to "prove yourself" are not easy to see in yourself, but they can have a negative effect on the outcome of personal interactions.

If you sometimes get negative results with other people, it can pay just to review and examine **your** needs, and those of the **other person**. Find the "win-win" opportunity. This is a crucial part of contributing effectively in the workplace (or any place).

## Your Boss

The above paragraph is the single most important key to dealing with your boss, especially the part about the "needs of the **other** person." Your needs, of course, are still important to you and in helping you interpret your own behavior, but don't assume they are foremost on your boss's mind.

Anything you can do to make your boss succeed will help you succeed. The person most effective (and visible) in helping his boss get a transfer or promotion usually has the first opportunity to replace him. When you disagree with your boss, you better be right. But more important, is it a point worth fighting over? And how likely are you to prevail? Some battles aren't worth fighting. Be known to feel strongly about just a few things; your opinions will have more value than if you react strongly to every issue that comes up.

## Your Peers

The old model where you "kowtow" to the boss, lord it over your subordinates, and are good buddies with your peers is no longer appropriate. Today's world changes too fast. Tomorrow any one of your peers could be working for you, or they could be your new boss. Just as sex will never be successfully

driven out of the workplace, neither will friendship. But, both sex and friendship are the **exception** rather than the rule. Relationships in the workplace should always be **professional** and only sometimes should they involve anything else. So, the best way to deal with your peers is to help them succeed and make it **easy** for them to **help you succeed**. It is seldom the case that you want their job, so **don't compete** with them for it.

## People who Work for You

You and the people working for you have a mission. That mission is your job. You, and every member of your team, should have the same clear understanding of your mission. Discuss it and write it down often enough to make sure. If you could accomplish your mission by yourself, you wouldn't need to have anybody working for you. Your responsibility to those that do work for you is to make sure they know what their goals are, and that they have everything they need to succeed. Success to your people is not only the accomplishment of their primary goals, but gaining recognition and advancement as well. The better you facilitate all three of these things for each of your people, the more successful you will be as their leader.

You can't do this without knowing your people. Each of them will have different styles of communication. Be aware of this and facilitate it. Some will prefer the independence of working alone. Some will seek out almost constant support and interaction, either for reassurance, or to feel part of a group. Some will be problem oriented; others will be people oriented. A few may even alternate.

Be sensitive to the needs of people and to the psychology of the group. Some people will seek little interaction and prefer the responsibility of their own problem or area. Others may work better as part of an interacting team. Some jobs have more work of one kind than the other. When people get together to solve a problem, you don't want them competing. When they go off to get the job done, competition might be their best incentive.

## Power

*Power* is a kind of psychological force that a person can use to control himself and others. Sometimes self control is called *will power*, but these are just two sides of the same coin. Power, like consciousness, is a complex **process** more than it is a force or state of being. Power has two aspects: Active and passive. Its active aspect is the art being practiced by the people who have it, move it between themselves, and transform it. The passive aspect is how each of us is affected by the power structure that exists in the human reality around us. Voodoo and witchcraft are a combination of power and superstition. You can eliminate your **superstition**, but the very fact that you are **human** makes you both susceptible to, and capable of, the application of power.

Most people gain relatively little *power* for themselves. In our culture various sayings denigrate the use and possession of power. We've heard it said that power corrupts, and absolute power corrupts absolutely. Power depersonalizes. Absolute power, absolutely. Power is only rented. Payment is inescapable. And, it is written, "the meek shall inherit the earth." All of these sayings help keep power out of **your** hands, and in the hands of those who already have it. A **knowledge** of power is **necessary**, both to exercise power over yourself, and to recognize the power others have over you.

The term *power* describes a complex social process that far predates human society. Its principles can be observed in a pack of wolves, in a herd of elephants, or in almost any higher social animal. Power is

the intentional influence of behavior, emotions, or beliefs: One's own, or another's. The inequalities between people are primarily inequalities of power. The human trait of obedience, and capacity for identification, are necessary to the political workings and power structures of organizations.

Revolutions have been fought to redistribute both power and wealth. And, indeed they have succeeded in taking it away from those who had it, but much of the wealth and almost all of the power is simply dissipated in the effort. The power has to be "reinvented." The Russian revolution seized both power and wealth. But how did its citizens fare? Has the average Russian become as wealthy as the average Westerner since then? Right after the revolution most of those who fought did not receive any of the power that was stripped from the Tsars. It resurfaced in the hands of a few leaders and was never widely shared. Another example is Cuba. After Batista was overthrown all of the power was gathered by Castro. Revolutions are not the way to distribute power or wealth to the masses.

Nevertheless, current social evolution may indeed be distributing power more evenly. Democracy was instituted in order to share power and to keep it from concentrating in the hands of a few. This makes the subject of power more important today than it has ever been. Power to the people is happening — bit by bit. Can the people handle it? Riots, mobs, and violence are not signs that they can. But, fortunately, other signs are more encouraging. The voice of minorities has seldom in history been heard as loudly as it has been lately, both in Russia and in western countries. Power plays a part in all social change. Let's take a closer look at it.

Power operates between one person and another, not between people and inanimate things. The control of power is a skill. Skills are best performed with a clear head and emotions in check. Power is something you **acquire** in a two step process. The first step is to be empowered by someone else who has power. The second step is to put your power into action. Power is seldom bestowed as a gift, it is more often sought after and won. Power is easier to get from a concentrated source. It takes great skill to gather it up in small amounts from the masses.

Power is meaningless to a hermit, and to most others it is only a force to be reckoned with. It can be of great use to a leader, and at least an object of great interest to a follower.

Power is also something that you **employ** in two steps. The first step is when you seek the cooperation of others. The second step is when they give it. The person of power subjugates others, but they must acquiesce.

Power also involves competition. The competition for power is a *zero-sum* game. In fact, for every person of power there are many who are not. So, it's a zero-sum game with a scarce resource. To be a person of power you must be a professional in the application of power. The reason for this is simple. Power involves a skill. Many people are talented amateurs in the application of this skill. In fact, the application of power is something that our species has evolved to a fairly high degree. That's why it takes a professional level of competence to succeed. For every winner of power there must be many losers. Some of the losers will have been contenders; they will feel the sting of their loss. The rest will have surrendered it willingly.

It is important to understand the dynamics of power because they control social change. All of us are affected by power; a few wield it to a greater extent, many to a lesser extent. Certainly, all of us are capable of power over ourselves, but few of us develop this ability to its full potential. This brief introduction is intended to acquaint you with the nature and existence of power. If you wish to **employ** power on yourself or others, you must develop a skill. Skills are developed by emulating others, not by learning them out of a book.

Power is a natural part of human society. Power works to the benefit of more people when it is distributed. Major shifts of power seem to result in great dissipations of energy. A better process involves smaller shifts of power and more often.

## Equality

Equality seldom happens in nature. Reality is never quite the same for two different entities. But, if you separate out a single component of form, or an aspect of existence, or an item of information, it may be possible to **measure** it in two different things. If there is no repeatable or significant difference, the two things may be judged equal with respect to that one attribute or property.

The equality relation is *symmetrical* and *transitive*. It's symmetrical because "A equals B" implies that "B equals A." It's transitive because "A equals B and B equals C" implies that "A equals C."

**Inequality** is much more interesting. While there is only one way to be equal (albeit in many different respects), there are an infinite number of ways to be unequal (even in a single respect). If A is not equal to B, A may be any measure less than, or greater than, B. This relation is not symmetrical. However, if the fact that A is less than B and B is less than C, implies that A is less than C, then the relation **is** transitive.

Not all inequalities define a relation, and not all relations are transitive. Blue doesn't equal green, but it is neither less, nor greater, than green. This type of inequality does not define a relation, it involves the possession of attributes. Some relations are not transitive. An example of such a relation comes from the old paper, rock, and scissors game. Rock breaks scissors. Scissors cut paper. And, paper covers rock.

Another relation that is not transitive is the number of people who vote for a candidate. In three elections, with two candidates each, it's possible for A to beat B, B to beat C, and C to beat A. This can happen even with rational and consistent voters. In a three-way election, a different result could occur. The same thing can happen in sports. Player A may consistently beat B, B may beat C, and C may beat A (it can happen!). This revisits our earlier subjects of *mathematics* and *logic*, but it can all be summed up by saying:

> Simple things may have complex causes.

In reality all men are **not** created equal. In the reality of human society, rights are related to ability, and ability is related to *duty*. Abilities dictate what you **can** do. Duty is what you **should** do. Rights are what you **may** do. Rights are typically granted with the assumption of duties and therefore are gained by developing your abilities. For this reason, rights involve regulations, while laws, which should apply equally, govern opportunities.

## Duty

As a species, humans have evolved abilities to assume many duties. As individuals, we develop our abilities to assume duties within the structure of our society. Those who take on and fulfill a certain level of duty tend to gain an equivalent level of rights. This determines one's position in the great inequality of life.

> A frog was once offered the job of eating all the flies that were bothering a hyena. Worried that his duties might lead in turn to his being eaten by the hyena, he wisely gave up his right to eat the flies.

Most of what we do when we are young, we do because we can. As we grow older, we find that we can do less. As we grow wiser, we tend to do fewer things for no other reason than just because we can.

Society is man's way of arbitrating people's rights. Society recognizes abilities, expects duties to be performed, and regulates where one person's rights end, and another person's rights begin. Society's laws and regulations aren't perfect. They evolve. Also not perfect are some of the individuals that get assigned to enforce them. They can always be replaced. Learn the general principles; learn how to apply them to each specific case.

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We will talk about duty again in future chapters. So far, in this chapter we have talked about the inequalities of power, and about inequality as an abstract concept. We have seen that inequalities of power place people in different and asymmetrical positions, but that other kinds of inequalities (or differences) are symmetrical. This lays some groundwork for the next topic.

The natural sequence of events in making one's way in the world is to acquire skills, a job and career, and then a spouse, and family of one's own. Every part of this requires men and women to be in contact. To be successful at all, one must know how to deal with members of **both** genders.

## Gender Differences

In today's society, dealing with the other *gender* is more complex than ever. It is in a state of flux around the world. Practically every geographical region of the world has a different paradigm, and the paradigm is shifting very rapidly in many places.

Two types of mistakes should be avoided in dealing with people of the opposite gender. One mistake is to treat all people the same regardless of gender. Another mistake is to form a stereotype (a shortcut to understanding). This leads to wrong and ineffective ways of relating to people.

How different **are** men and women? Here's one train of thought that offers an answer. We have 46 chromosomes, and one of those differs between males and females. That means, very roughly, that one part in 46, in other words just over two percent, of our DNA is different between men and women. Does that ring a bell? That's slightly more than the DNA difference between humans and chimpanzees!

In terms of genetic **quantity**, this evidence suggests that men and women differ as much as people and chimpanzees. The point here is not to compare one sex to a chimpanzee, it's to show that differences exist, and that they are **considerable**. Let's **learn** about them. Let's don't make the mistake of ignoring or denying them.

Men and women have evolved to work together in cooperation, not in competition or as adversaries. We are like "two hands clapping." Success requires working together, and failure to work together is a threat to our species. Even though we evolved to cooperate, each of us has slightly different sex-linked self interests. One of the more obvious is the different minimum efforts necessary for a man to become a father and a woman to become a mother (very small versus very large). Since both have an equal genetic interest in the outcome, men and women have evolved to make life-long commitments to one another.

Based purely on physical differences, there is an inequality in what a man and woman commit to each other. One fundamental difference, for example, is that a man can have offspring both at home and away. A woman can **only** have her offspring at home. She always knows she is their mother; but a

man can never be as certain that he is their father. Another difference is that a woman makes a large investment in her **own** offspring, no matter who the father is. A man, through his commitment to a single woman, may also make a large investment in **her** offspring, usually expecting them to be **his** offspring, too. Each may be expecting to invest only in their own offspring, but the man depends upon the commitment of the woman to make this happen; the woman **knows**, without any promises from a man, whether the children she raises are her own. These are the fundamental asymmetries of gender.

Throughout most of our history as a species, the male has attended to business in the company of other males and has roamed far afield to do it. Females have stuck closer to home and have tended to keep the company of other females. To a great extent, this situation was in place even before humans evolved. The male satisfied his primary obligation to the female by bringing the fruits of his efforts back to their home. The female satisfied her primary obligation to the male by bearing his children and maintaining continuity and order within their home and the extended family or tribe.

It is impossible for our genetics or our basic natures to change in any short period of time, even in thousands of years. But, western society **has** changed radically in just the past few centuries. In the U.S. and Europe, men are spending more time at *home* and women are spending more time in the *workplace*. Neither has to spend their full time to satisfy their previous "duties," so men have more time to help raise children and do things around the house, just as women have more time for a career.

Men and women have a much greater exposure to one another than ever before. They come together under more circumstances, more often, with more opportunities to interact.

This increase in dynamics may be the reason for the dramatic rise in **tensions** between the sexes. The roles are not as simple as they once were. Today's roles do not conform to the paradigm that evolved over hundreds of thousands of years. The divorce rate has gone up. The family unit is breaking down. In the world of the past, men and women had very limited contact with the other gender outside their immediate family. Except for during childhood and into puberty, contact was minimal. Social pressures **held** it to a minimum. Society evolved *scripts* for the contact between genders. These meant learning how to relate to a sibling, parent, child, and mate of the opposite sex. Now, when meeting someone of the opposite sex in society at large, many more situations occur, and stable "scripts" are just now evolving to deal with them.

This is a different problem for men and women. Since women seldom encountered men in the world at large, they needed no script to guide their behavior. Men have evolved behavior that helped them encounter other men in the world at large, but this behavior turns out to be inappropriate in many of the encounters with women. So, neither men nor women know how to behave (on any evolutionary basis) toward each other when they meet outside a sexual context. Societies all over the world are going crazy trying to deal with this problem as it reaches crisis proportions in each geographical area.

## Two Different Worlds

Men and women, to an extent that's almost scary, live in two different worlds, two different paradigms. We could characterize these two different worlds as masculine and feminine, but this association has arisen (as usual) out of both chance and necessity. Many men and women are able to "cross over" to the opposite paradigm, but women are definitely more talented at dealing with one, and men more suited to dealing with the other. Let's take a look at these two paradigms. And, as you read the following, keep in mind that we are discussing only that 2% difference between men and women. Most of the human talents and abilities are shared very equally between men and women, and given a

particular ability of any man or woman, there is probably (statistically speaking) another woman or man with more of that ability.

First, let's talk about the paradigm more commonly associated with the feminine side. In this paradigm the greatest importance is placed on viability and interaction **within** a group. The group may be the relation between a man and a woman, it may be a family, club, or institution, or it may be a community, a country, or all of mankind. In this paradigm, a woman focuses on dynamics within a group, seldom on herself alone. She focuses not on hierarchical position, but on how deeply secured and accepted she is within the group. The purpose of social interaction is to bind the group together and secure closer connections between its members. In this paradigm, feelings are important. Equality is sought. Bonding and sharing are necessary.

The paradigm more commonly associated with the masculine nature is that which places importance on objectives, competition, and status. Often, the male focuses on himself as a single rugged individual "going it alone." A masculine focus, for example, might be on the standing of his team, or his status within the team. For him, the purpose of social interaction is to gain status and standing for himself. By increasing his status within his group, he gains a greater measure of control over it. In this paradigm, action and outcome are important. Status is sought. Control is necessary.

These two paradigms are at **right angles** to each other. Instead of calling these paradigms feminine and masculine, let's use *horizontal paradigm* and *vertical paradigm*. These terms denote the fact that the two paradigms are orthogonal. And, they emphasize that the important aspect of one is a horizontal, or level playing field, with all the players on it together as a team. The important aspect of the other is a vertical dimension, where position describes status, interaction involves competition, winning or losing, and motion implies a change in status. More importantly, the terms horizontal and vertical don't imply that these concepts connect only to gender.

Power may be sought in either paradigm, but different skills are involved. A woman, skillful in her craft of power, may succeed in certain social environments to the complete bafflement of her male competitors for power. These are environments where she can make use of flows of information and connections between people. She may shape the perceptions and attitudes that people in the group have in regard to one another. Men are less likely to command these skills. The skillful use of power in the horizontal paradigm is almost like sabotage to those whose power derives from the vertical paradigm. This is because empowerment in the horizontal paradigm often comes directly from the members of the group, rather than from above in a hierarchy. More often, men seek direct alliances, loyalty, and the establishment of rules and codes of behavior as the basis of their power. Women may prevail by collecting a consensus from a majority of the group, while men may expect to prevail by fiat.

However, when a woman is operating in a horizontal paradigm and a man in a vertical paradigm, the fact is that their paradigms are ninety degrees apart. This means that much that is important to either of them is not even **visible** to the other! *Logic* can't be used to close this gap, because women tend to use logic to rationalize their **feelings** and men tend to use it to rationalize their **actions**. As you may have observed, or might suspect, this has a profound effect on the relations between our two genders!

## Gender Relations

Differences between people exist. Especially between the sexes. But also between people of different ages, religions, and ethnic backgrounds. In fact, the differences between us make each of us unique. We may rightly be striving to build a society that offers equal **opportunities** to everyone, but it is simply

not possible (and probably not desirable) to ignore, suppress, or attempt to counteract the **differences** (the inequalities) between people.

When someone mentions a difference between people it is often taken personally. Usually it's a difference between you and them, or you and some group. When someone implies that we are different, we tend to see their act as aggressive, and it puts us on the defensive. Moreover, the speaker may be in a position of greater or lesser *power* with respect to the person being spoken to. The assessment of relative power, and the offensive or defensive position, may be different for each of the two people, and it is usually unconscious. The speaker very seldom **intends** the consequences that follow. However, the person being spoken to often "hears" the following **implications**.

If the speaker points out a difference, and is a person of greater power, the listener may interpret the difference as a slur:

1. "We are different" implies "**you** are different," and
2. "You are different" implies "you are **inferior**."

On the other hand, when the person of lesser power points out a difference, it may be interpreted as an accusation:

1. "We are different" implies "**you** are different," and
2. "You are different" implies "you are **at fault**."

In this book many differences are pointed out. Differences between men and women. Differences between how things are and how they might be. Differences between how I see things and how you might see them. I can only hope that all the differences I mention here are not interpreted in **either** of the ways just mentioned.

If two people are operating in a similar paradigm, the reaction to an unfamiliar idea may be one of interest or indifference. But if the communication crosses from one paradigm to another, it may provoke anger, fear, or discomfort. Different styles of communication require different paradigms. Different rules pertain. As a reader, it is much easier for you to adjust to the paradigm that best allows the sense of this book to be understood. But, in the real world, it is very difficult, and few people even understand that it is useful, to adjust paradigms when interacting with different people, i.e. people with differences (gender, power, group affiliations, wealth, etc.).

Your particular circumstances **assign** your gender, your ethnic ties, your power, and other attributes. In each interaction, these are givens. Try to be sensitive to these aspects of reality. Don't be afraid to see differences that truly exist. If someone points out a difference, don't fall into the trap laid by alternate paradigms. A fairly innocent statement in one paradigm, can be nasty or aggressive in another paradigm. If you happen to make the offending statement, you can recognize or ignore the fact that the other person may fall into the trap. If only one person recognizes it, the rest of the dialog can be adjusted and the traps avoided. So, let's take a closer look at how we get into some of these traps.

Men, for whatever reason (cultural or genetic, it really doesn't matter), are very sensitive to the existence, establishment, and changes in a pecking order and disputes over "turf" and their "right" to lead. Women are more sensitive to changes in distance or closeness between people and whether they themselves follow, or are followed by, the group.

Because of their ninety degree difference in "hot buttons," men and women often don't notice the "hot buttons" of the other. Perhaps women comply more easily to the requirements of a hierarchy because

they view it as part of the give and take in a larger picture. Men tend to want to move **up** in the hierarchy, and this means that giving orders is better than taking them. On the other hand, men tend to be more adaptable (read less sensitive) to changes in a relationship **between** people. Except for being highly sensitive to any signs of a sexual come-on, men tend to be relatively insensitive to the small things that signal greater or lesser intimacy between two people.

These are age old cultural, possibly even genetic, differences between the way men and women approach social dynamics. Each could benefit from knowing how the other looks at things, not only to get along with each other better, but also because two different social worlds are involved. Both men and women are coming more and more to inhabit both of these worlds.

Men could benefit from an awareness of, and an expertise within, the *horizontal paradigm*. Many are already operating within it without this awareness and with no expertise at all. Likewise, it is not the case that a woman must be "masculine" in order to gain expertise within the vertical paradigm. Many interactions occur within it.

It's not useful to convert every situation to the paradigm we may **prefer**. And, as individuals with limited power, it is impossible in most cases anyway. Many situations will consist of a mixture of people in a mixture of the two paradigms. These situations are prone to conflicts that arise through misunderstandings. A truly effective leader might be able to shift the group paradigm to the more effective paradigm. If equal members of a team are involved, if the activity is brainstorming or start-up, this usually means to the *horizontal paradigm*. If the hierarchy of the group is involved, if the activity is goal oriented and the people already form a well-knit team, a *vertical paradigm* may be preferable.

## How Did We Get This Way?

The typical male vertebrate behaves in a way that almost prohibits a high degree of social order. An adult male is aggressive, solitary, and competitive. Judging from the groupings of social animals we find in nature, there exists a cohesion among females, and between females and children, but the evidence suggests that there is no inborn cohesion between father and son, or between male and male. To live together in society as we know it, some form of bonding relationship must make up for this. The bonds between males in our society exist as a result of culture; they are "forged morally."

Father and son, male and male, are connected to one another by the mystery of reason and sense. They are connected by "words" that convey linguistic meaning and understanding. They are connected by their laws, agreements, and expected behavior. They are bound by mutual understanding and common culture, things captured by logic and reason, subject to common sense, patterns conveyed by language and forming styles of thought. The sense and reason that evolves out of the use of language permits the sharing of patterns within which a father can identify with his son and permit his infancy, a son can identify with his father and become a man, and within which one man can understand and allow the equal manhood of others.

Before the evolution of spoken language, there is reason to believe that our ancestors evolved a *body language* for perhaps millions of years. This language is still very much alive. Body language deals with precisely the same issues that define the horizontal and vertical paradigms. It deals with intimacy, bonds within a group, status within a group, territory, and many of the skills involved with the use of power. It involves facial expression, eye contact, position of head and limbs, and physical interactions between two people's personal space.

For example, a weak smile may indicate supplication, yielding to a person of superior status. A normal smile indicates pleasure or agreement. Together with other cues, smiles can range from sexual come-ons to menacing and aggression.

To borrow a term from the animal kingdom, body language also includes “preening” behavior. Arranging ones clothes, hair, and makeup are often a sign of sexual interest.

Body orientation is another component. Facing one another, leaning toward one another, sitting, and crossing arms or legs, these are all ways of shutting out the world and increasing the closeness or rapport with another person. Turning ninety degrees from the other person to face in parallel with them is generally done between males to eliminate a challenge to status, or a direct confrontation.

Eye contact is also used in different ways. It may be a challenge in a vertical context, indicate closeness in a horizontal context, or be used for punctuation during a conversation, and to hand over “permission to speak” between speakers.

Everyone speaks and understands a body language. Unfortunately, we have many different dialects. You must become conscious of the fact that it differs from place to place, and person to person. Body language is spoken and reacted to on an unconscious level. You may be conscious of it when learning it, but you must learn it well enough to be unconscious of it when actually using it. Most of the operation of body language in the vertical paradigm is oriented toward distancing and control of territory. These are used to indirectly set status, or vie for a change. The most **common** use of body language is in the **horizontal paradigm**. It is used to bring others into a group, state how one is feeling in relation to a group, and for flirting and most of sexual courtship.

You can use, or observe, similar versus opposite body positions. They may be body language signals, or just markers. In a group, people who are in accord and agreement usually adopt similar body positions. Those who are not, who object, or would like to lead some of the others away, adopt a different position. In a face-to-face encounter, you can agree by adopting a similar position, disagree (disapprove) with a different position, or by signaling intimacy in some way, attempt to “win” someone over to a different emotional state with an opposite position. For example, if the other person is standing stiffly with arms crossed, you may be able to get them to relax and accept you by looking relaxed and letting your arms dangle. In speaking, you might use hand motions that momentarily invite an embrace.

Body language signals what a person feels. In a card game with the same people each week, you can gain a tremendous advantage from their body language. If their pupils dilate, they have just drawn a good hand. If they scratch under their nose, they may be puzzled, or perhaps angry about their hand. Other positions and expressions will also tell you, once you learn to read them (They aren’t all standard! But, they are almost always consistent.), what kind of hand or strategy the person has. Very few players can hold a poker face clear through a game. A person may become chatty or withdrawn. They may even try to emit false signals, but hiding behind a mask, or poker face, is usually the best that most people can do.

## For Women Only

Society has changed the life of women a very great deal in the past several hundred years and especially in the past few dozen. Men’s roles have evolved more slowly, but the rapid influx of women

into those roles has made some non-trivial changes in his life too. You need to understand two things to learn how to cope.

First, evolution, both genetic and social, has left men and women with the significant differences mentioned above. We will see how these must be taken into account. Second, there is the present paradigm of society and how to best cope with its new roles for women. Society can **decree** change overnight, but change takes much longer than that to actually **evolve**.

In the U.S. it has long been the case that men and women have had equal rights to education, to vote, and to jobs in the workplace. Sex does not control success in these areas. Therefore, theory and practice should be able to come together in relatively short order. For every job in today's job market there is some woman who is better qualified than most men, and vice versa. Likewise for education and running the country. But, reality doesn't recognize nor evolve toward what **should** be, reality is simply what is. It evolves along lines that worked in the past.

Let's look at the historical foundation that you as a woman stand on, where your strong points are likely to be, and where the new territory is for you. Women make the major direct investment in children. Women have historically run the household. A woman's world has traditionally been centered, rooted, and focused. This doesn't mean the "woman's **place** is in the home," it means a woman may have a head start at keeping a group together and making it run smoothly.

Today's "new" territory for women involves responsibilities outside her home, and allegiances that may have little to do with her family. It involves forming and working those allegiances. This means manipulating and being manipulated by other men and women over issues that have no direct connection to home and family. It also means competitively making available her skills to an employer or an endeavor that needs them.

Let's assume you intend to take on these outside roles. In doing so, you may find two kinds of problems. The more fundamental are those that define a person's level of career commitment. If you were to run your own business, your customers would expect a level of commitment from you in return for their patronage. Will you be there every day from opening to closing? Will you be there next year? In twenty years? Any employer is simply a single customer with the same insecurities and desires. Society is evolving toward the day when a couple will choose which parent is to make this commitment, and which is the one who will take time off to handle household emergencies and spend the extra time required by their children. Some couples will share. Other couples will disagree and separate, making cooperation much more difficult.

Many women today have no immediate interest in a husband or a family. Others do. Those that do, have compromises to make and obstacles to surmount in the workplace. For every one of them, there is a man affected by the same compromises and obstacles. Employers tend to worry about these women, but not about the men. Why? History. In the past, a very small percentage of men in business had to share the problems of home and family; their wives took care of these things. The greatest share of this responsibility has traditionally been assumed by women.

It may not be legal for an employer to ask about these things, but it's still human nature to worry about them. When there's a chance these issues could be called into question, be up front about them. If you are single at the moment and want to begin or further your career, make this known. Make your status known, whatever it is. Just clearing the air will make you a person, not a source of anxiety. You could be an unmarried black woman with two children at home, and feel that this might put you at the bottom of the hiring list for some job. If **you knew** that you could contribute the hours, skills, and reliability

required, you would be selling yourself **and** your prospective employer short if you didn't make **all** the facts clear. Facts dispel uncertainty, and no one is hired or promoted on the basis of uncertainty.

The most spectacular successes and accomplishments probably come from people who share very little of the burden of home and family. However, most of the jobs available aren't suited to these high achievers. Seek the job that fits **your** lifestyle and make it a point to communicate that fit to your employer. If your employer sees that your job comes first when you are at work, an occasional crisis at home can always be negotiated. But, what if you're a woman who has children and wants the major commitments of a career, or a woman who has a career and now wants to have children?

In theory, a woman could have all the children she might want during a two week's vacation every year or so, but these "super children" haven't evolved yet. For one thing, your children require your full time for their first several years.

Some "compromises" on our human "design" are possible. Parents should decide for themselves if they wish to make these compromises. Ideally, you should nurse a child for a year or two. This time **can** be made shorter and there **are** alternatives. But, in the ideal case, you should attend to your child personally for at least its first three years. Employers may offer from zero to twelve weeks **paid** absence, and up to 18 months **leave** of absence for a mother to care for a new born child. In **neither** case is this really enough. So, for a woman who wants children, a compromise must be made with the ideal practices of child rearing, or with her career.

The most important thing, the responsibility for which is primarily yours (duty relates to ability, remember), is to ensure that your babies get the amount and kind of attention they need. After your baby is several years old, this responsibility can be shared more equally by a couple. A day-care service can take over part time.

Once you have all the issues with home and family resolved, you come to the second kind of problem a woman faces in the world at large. This stems from the necessity to manipulate and be manipulated by other men and women. This is a requirement that relates to *power* and position in a hierarchy. It requires you to recognize and gain expertise in the vertical paradigm.

Ten thousand years ago this was only a problem for a man who had to learn to manipulate and be manipulated by other men. Now, it's a four-fold problem for women entering new territory, and a two-fold problem for men when they encounter women (this assumes that men can retain their "old methods" for dealing with each other, but that, too, may be changing). In any case, women now need four "scripts" to follow: One each for **manipulating** another woman or man, and one each in being manipulated **by** another woman or man.

Women of similar age have traditionally come in contact with one another on fairly equal footing. The "pecking order" between women, where it existed at all, has been based on age or popularity within a group. Now, women of all ages must come together in the workplace under a different set of rules. It's not clear that women have evolved rules for manipulating and being manipulated by other women to the same extent that men have done. It's also not clear that the same rules will suffice between women as between men. It is clear that this is a "problem" area and that the "stereotype" behavior that ultimately develops needs to be "professional" in ways that behavior within an extended family, or between "school chums," has not needed to be.

The two remaining situations are perhaps even bigger problem areas. How do you behave when you need to manipulate a man, or are being manipulated by a man? This may require operating in the

vertical paradigm. If you try to manipulate someone else, who is already in that paradigm, from the horizontal paradigm, you will be seen by them as nagging or being too indirect. You must gain an equal or upper hand, and this can only be done with direct confrontation and eye contact. Be businesslike and professional; let him know that you expect the same behavior from him.

The vertical paradigm isn't just about getting the upper hand and manipulating others. For every person doing the manipulating, there are one or more persons being manipulated. These people need to acknowledge the right of the other to lead, but they must also save face, preserve their own dignity, and maintain respect. Men have evolved a whole repertoire of behavior that serves some of these ends for them. Not all of it generalizes to women.

The ultimate behaviors won't evolve in our lifetime, but there are some guidelines that will get you by for now. Outside your home and circle of friends, treat both men and women with professional respect, courtesy, and distance. If they don't treat you that way (and, by the way, neither expect nor demand them to), treat them to a little more distance.

*Body language* is another subject that differs between the sexes. This subject involves where you are looking, how close you are, or move, to another person, how you are standing or sitting, and what you do with your hands. All of these factors operate whenever you are in view of someone else. Women are probably more **conscious** of the signals given off by their body language; men are probably more **affected by** the signals of another. Both of these factors can be worked to your advantage.

When you look at another woman, chances are, both of you are in the horizontal context. Your eye contact signals coming closer and making rapport with the other person. It's very much the same when you make eye contact with a man, however two distinct alternatives are possible. Coming closer and increasing rapport with a man may be interpreted as *flirting*. If you want to accomplish the former, but avoid the latter, you must set the proper context (or avoid the improper context). The other alternative is that the man is in his vertical paradigm. Your eye contact is part of jockeying for, or holding, your vertical position with him. Again, the context will make this clear. If you don't make eye contact back, your body language is telling him that you accept a lower status. If you are "supposed" to be equal or superior to him in the given context, you must maintain that position with eye contact and conversational style. If you want to **gain** that position, you have to **exceed** his.

Let's take some situations in which you have to interact with a man. Two are the customer salesperson interaction, where you could be on either side. Another two are the worker boss interaction, again you could be on either side. Finally, there is the peer interaction. Here it doesn't matter which side you are on; they are the same, but the others differ depending on which side you are on. In all of these situations, your goal should be to facilitate interaction. If you are in charge, **indicate** your status; but if you are not, you should indicate **that**. Both are done with eye contact (or looking away), gestures, tone, and content of the conversation.

When you interact with anyone, one on one, you may be able to interact within the horizontal paradigm. This also means making eye contact. Your objective is to bring yourself into rapport with the other person. In looking at them, you can tell if they are operating in a vertical paradigm. If they are, you either have to get them out of it, "win them over," or you have to accept it, and change modes. If you look away, you become submissive, and you will have reinforced them as being in the superior position within their vertical paradigm. The way to avoid this is to keep the eye contact, defuse their aggressiveness, and try to "make friends."

This approach **may not** always work, and it **is not** always the best. It's **not** the best, when a hierarchy really exists and others may be leaving you behind within it. For example, peers in front of their boss. Peers advancing themselves and their suggestions in front of each other. When the situation is one in which you would like to prevail, you are dealing with a vertical paradigm. At other times, a horizontal paradigm might be more effective to get the job done. If the main problem is brainstorming, or bringing people together on a new team or endeavor, then a horizontal paradigm is usually best.

Whether you just like the horizontal context, or it is really best for the current situation, everyone must be working in the **same** context. If you can't accomplish this, it's better to switch than fight or flee. The vertical paradigm often dominates. Even when it's not appropriate, it is often cultural. Simply be aware of it. You have to believe that you can gain and hold status and still be feminine.

## For Men Only

Women are a fact of life in the world's workplaces. Some of them can do your job better than you can. Do yourself a favor, and help them make the best of it. These words, coming from a man, say to another man "tough it out!" But, imagine that a woman had said this to you. Does that make it seem threatening? Perhaps, and if so, it's a clear indication of how far we have to go. We need to connect with one another, not just dominate one another. Even where the workplace is only filled with men, the latitude of this other social dimension gives the man who acquires it an edge that other men may not have.

How do you view a woman in the workplace? Do you see her as out of her element? As competing for your job? As someone who will soon be married or having a baby, and therefore taking up more resources and making less of a commitment than a man in the same job? Or, do you view a woman as having an equal right to do equal work for equal pay? In other words, does a woman have the right to enter a level playing field with a man?

Some men want to be the sole provider for their family, and their wives are happy to run the household and look after the children. Other men abandon their wives. Still others have no families at all. Finally, there is a growing number of men who choose women that wish to have careers and **share** household responsibilities.

No matter which group you fall into, you have to grant that the other groups exist, and have a **right** to exist in today's world. Perhaps in the past only the first group was granted a legitimate right to exist by society, but there have always been men in the second and third groups, and therefore there have been **women** as their counterparts. The women in the first group who were not happy being there, and all the women in the second and third groups, got unfair treatment by society (by men). Society is finally moving to correct this. If a man chooses to remain single, why shouldn't the single woman be his equal? If a woman chooses to remain single, is the man who is left single entitled to better status?

Today, a man may have a career and support a woman, both may have careers and somehow take care of their children, or a woman may have a career and be the primary provider of her family. You may have adopted one of these scenarios over the others, but other men may have chosen differently. Let's start from your situation and see how you can best view women in the workplace.

If you have a working wife, you should treat other women in the workplace the way you would want her treated. Otherwise, put yourself in the place of a man who does have a working wife, and treat women the way he would want his wife treated.

If you're single, maybe you can't imagine how you would want "your working wife" to be treated. Perhaps you harbor the feeling that a single woman is just marking time in her job until she gets married, and in the meantime she's competing with you for your job. If the woman you encounter is single, it also might be harder to keep sex out of it.

One of these views involves a stereotype. Many encounters can be stereotyped and handled with minor variations on a "script." But, the stereotype of a "woman marking time in the job market" has no useful scripts associated with it. So, cancel that stereotype and build a set of scripts that treat both married and single women alike. For purposes of the workplace, treat both **women and men** with professional dignity and courtesy.

Every encounter between a man and a woman has the potential for involving sex. In many, sex is **not appropriate** and you have to develop other styles of behavior to use instead. Sex is appropriate only when **mutual** flirting occurs, and even then it may be unprofessional.

## Back Together Again

We have explored some of the reasons people get together, what they do together, and how they interact. People have different talents and they can contribute those talents as individuals working alone, or as members of a group working closely together. Ultimately, the contributions of an individual work to the benefit of a group and of society in general (or fail to do so). It's becoming more important to learn how the individual can be more productive and increase the *creativity* of a group.

Whether an individual is working alone or within a group, there are at least three aspects to the creative process — the process that solves problems, perfects designs, sets goals and objectives, and figures out who does what in order to get there.

These dimensions of productivity measure a person's position on three axes, describing a point within a cube. A person's mindset can be anywhere within the cube, but generally it is most effective in one of the corners (at one of the extremes). This is because each of the axes describes a function that is polarized. People operate at one extreme or the other, but with great difficulty at both poles at once. When all of the people within a group can spread out into different positions within the cube, and interact well, they can become remarkably effective.

The first dimension within the cube is skepticism. The complete skeptic can raise objections and point out the problems. The opposite of the skeptic is the credulous attitude of the believer. This attitude is effective for taking an idea and applying it to everything, finding ways to make it work. Neither should be trying to sell or kill the idea, but only taking a positive or negative attitude toward it and pointing out **reasons** that might make it fly or die. One of these plays the role of the "fit finder" and the other the role of the "fact finder."

The next dimension is that of logic. At one extreme is the linear and goal oriented approach of the scientist or engineer. At the other is the completely intuitive, parallel, and holistic approach of an artist. The mindset and talent for assuming one of these positions determines what kind of contributions each of these may make. The *logic* of the scientist and the *intuition* of the artist make quite different contributions to the generation and evaluation of ideas.

Finally, we come to the dimension of ideas versus people — jumping tracks versus keeping on the track. At one end of this axis is the creative person with new ideas and alternatives. At the other, is the person who acts as the gate keeper, who tries to keep track of things. The gate keeper helps people

get their fair share of interaction and stay in contact with the group, minimizes conflict and keeps people on a level playing field without shutting down anyone who might be “on a roll.”

* * * * *

Let’s review some of the ideas we’ve covered as men and women separately and together. We’ve learned that this is a new world. We’ve explored the orthogonal spaces of male and female. And, we have found business creeping **into** the decisions of home and family. We’ve learned that the vertical approach is superior at some things. The horizontal approach at others. We should appreciate and cultivate both. We should know when each is appropriate.

Every real world situation maps into both dimensions, but some more effectively into one or the other. When some of the people in a group are operating in one dimension and some in the other, even when it’s one-on-one, these people will be operating at cross purposes, and to some extent undercutting and alienating themselves from each other. They will be ineffective, even obtuse, from the other person’s point of view.

We have covered topics ranging from business to body language. Body language includes conversation, tone and loudness of voice, facial expressions, eye behavior, and the positions of head, arms, and legs. The language is one of intimacy, territory, and dominance. It operates in both paradigms, vertical and horizontal. Body language begins with an initial statement, and continues with feedback in one of several directions, toward the successful conduct of business, toward increasing a friendship, or toward sexual intimacy.

How has our species evolved a more stable and complex society than, perhaps, any other animal? The evolution of our society has gone hand in hand with the evolution of our linguistic abilities. Body language and spoken language, the moral structure they enable us to encode, and the bonds they help to forge between the individual members of our society, are the essence of our *ancient covenant*. Until recently, this covenant lay buried deep within us.

# V. The Process of Creation

Each of us was created, not in a moment, but over time. The process began with a single, fertilized cell. This cell was not a tiny copy of the human being that we eventually became. Nor did it describe a human being in any way. It was the first step on a long road. It pointed the way to the next step down that road. Time and events, the information coded into that cell interacting with its environment, all worked together to reveal the human being that each of us is today.

We were fashioned from the raw materials of the earth according to the instructions contained in our first cell. Our destiny includes growing up, growing old, and then surrendering our substance back to the earth. Our growth began with a process called *ontogeny*. This process replicates, in some respects, the entire course of man's evolution. Each of us inherited from our parents, and they from theirs, the organizing principles that guided our growth and development. Our lives are based on a genetic and cultural legacy. Life is our opportunity to contribute to that legacy for those that follow.

## Human Ontogeny—A Short Course

There are two ways that cells are copied to produce other cells. One is through the process of mitosis. This is the ancient process of cell division. Even more ancient is a process of DNA replication that occurs inside a cell or other conducive medium. This process is followed when mitochondrial DNA and viruses replicate. These processes produce nearly exact copies. Genetic drift is very small.

The second way that cells can produce a copy of themselves is through the process of *sexual reproduction*. In this process, two separate organisms each donate half of their DNA into two special cells called gametes. The female's gamete is called an egg. The male's is called a sperm. At fertilization, an egg and a sperm combine into a zygote, a single cell with a full set of DNA. This process does not produce an exact copy of any cell. Genetic drift is much faster. It is subjected to all kinds of selection processes, including those that influence the selection of a mate.

What happens in the first few minutes of conception took evolution about two billion years to discover how to do. The incredible feat that occurs within these few moments is within the capability of virtually every plant and animal on earth. Some of them perform it many millions of times in a single lifespan. It is both a miracle and utterly commonplace at the same time. It is no more or less a miracle when human beings initiate a copy of themselves than it is when frogs or flowering plants do it.

Four complex and interlocking systems were evolved to accomplish the feat of conception: The design of a cell, the incorporation of the mitochondria and its DNA into the cell, the design of the nucleus of the cell and its DNA, and the design of a sexual delivery system that utilizes a copy of nuclear DNA from each of two parents.

## Conception

Conception is the process whereby half of a male's nuclear DNA enters a female cell that is missing half of its nuclear DNA. The female supplies all of the structure of the initial cell except for the DNA that completes the cell's nucleus. This means that the female supplies all of the mitochondrial DNA. The sperm cell is the smallest cell in a human body. The egg cell, some 400 times the diameter of the sperm cell, is the largest.

The cell nucleus is built by coiling similar strands of DNA together from the male and female parents. Each complete strand, containing many individual genes, is called a chromosome. Humans have forty-six individual chromosomes arranged in 23 pairs. Each chromosome of a pair is very much like the other, but one pair does differ quite a bit between males and females. This pair is known as an XX pair in a female and an XY pair in a male.

Every male receives his father's Y chromosome, and every female receives her father's X chromosome. Both receive one of their mother's X chromosomes, and all of her mitochondrial DNA.

Nuclear DNA is "shuffled and dealt" well in advance of conception. In fact, the female's contribution, which is contained in her egg cells, is "dealt" at the time she matures into an adult. The male continues to produce sperm cells throughout his fertile adult years.

When a cell divides, an exact copy of its DNA is normally passed on to each daughter cell. However, when a gamete, an egg or a sperm cell, is produced only half of the nuclear DNA is passed on. The shuffle and deal of nuclear DNA involves the random selection of one of the two chromosomes from each of the 23 pairs to produce a set of 23 unpaired chromosomes that are temporarily stored within the egg or sperm cell.

The main element of chance that enters into conception is which sperm cell happens to combine with the egg cell. At conception a complete set of DNA results from the 23 chromosomes of the male and the 23 from the female. Apart from the occasional extra, missing, or modified chromosome (another element of chance), this process gives each person a full set of 46 chromosomes arranged in 23 pairs.

## The Beginnings of Life

The question is often asked, "When does *life* begin?" The last step of the copying process is completed and a new and unique combination of DNA begins its process of ontogeny at conception. But, life is ongoing. Life began several billion years ago. All of the chromosomes that combine at conception today have existed for many **thousands** of years. Only their combination is unique. In other words, the deck of cards is very old, but a new hand is produced at every deal. Life is the **play** of the hand, **not** the hand itself.

The question that should be asked is, "When does a new **human** life begin?" What **is** a human life? My finger is a part of me, it is alive, but it is not a human life. If it is cut off, it dies, but my human life goes on without it. Thus, my various tissues and organs are not me. And yet, there is one organ that cannot be lost or replaced without the very real loss of my unique and human life, and that is my human brain.

You could cut off my hand and replace it with a hook, or one of my legs and replace it with an artificial leg. You could remove my heart and replace it with another human heart, or even replace my liver with that of a monkey, and I might live on. But, remove my brain and **nothing** can replace it.

Until the human brain reaches a sufficient stage of development, a **human life** has not yet begun. When a human's brain is no longer capable of a minimum level of function, that human life is over. Thus, it is not the state of the body, nor the combining of the chromosomes, it is the **condition** of the **brain** that is important in defining a human life. As we shall see, part of the brain's development takes place before birth and part of it takes place afterwards. Until we are born, we are no more than a parasitic growth within our mothers. Until our brain has developed the ability to perceive and remember, we are little more than basket cases, bedridden and totally dependent on the good will of others for some time after we are born.

## Life as a Parasite

The fetus of any mammal is a parasite until its mother gives birth to it. Growth proceeds in three stages. The first stage is one of simple cell division. The initial cell divides into two. Those two cells become four, the four become eight, and so on. This cluster of cells remains about the same size as the original egg. During this stage, development is relatively independent of the mother's body. It could, for example, be transferred to another "host."

The second stage, during the second and third weeks, occurs when the fetus develops a placenta that connects it to its mother. This organ, truly makes the fetus a parasite dependent upon a "host." The third stage is entered when the fetus is viable without a host. At this point, if it were to be removed from its mother and detached from its placenta, it could carry on life with intensive care, but it would no longer need to be a parasite.

In the third week after conception, when the human fetus is several millimeters long, certain cells become designated to develop into the brain. After seven weeks the fetus is over an inch in length. The emerging brain is now about three millimeters long, and about as complex as the brain of a flatworm. After the embryo period (eight weeks), the cells of the future neocortex appear, and the brainstem has an elaborate system of projections that will guide the migration and specialization of neurons in the future cortex.

During gestation, the brain becomes about one-fourth of its adult size, but it develops almost all of the neurons it will ever have. Before birth, some of the major nerve pathways, such as the spinal cord and the optic nerves, are formed, but most of the brain's connections are made after birth. The adult brain is four times the size of the newborn brain because the neurons themselves grow larger, the number of axons and dendrites increases, and each one makes more connections.

## Life as a Basket Case

During each of the last two months before birth, the brain doubles in size. It doubles twice again before it is full grown. During this time the brain is wiring itself. This happens in two phases. In the first phase the axon of each neuron seeks out its destination and grows a number of branches. The second phase requires neural activity. Muscles need to flex. Ears need to hear. Eyes need to see. Most of this activity takes place after birth, while the baby lives in its "basket." This is a crucial stage in the baby's life. It must be stimulated through touch, speech, and images if these connections are to develop

properly. Too little interaction will retard the baby's development irreversibly. Current studies show no indication that an excess of stimulation is particularly helpful, but too much is better than too little.

## Sex Differences

Twenty-two and one-half pairs of chromosomes guide the development of a "basic" human being. The last chromosome may be another X chromosome, emphasizing certain aspects of the basic plan, and spelling out how to make a female human being. Or, it may be a Y chromosome, spelling out a set of changes to the basic plan.

To build a male, the basic plan is modified so that the sex organs, the ovaries and uterus, "drop out" of the body. The ovaries are modified to become the testes and the uterus is turned inside out to become the scrotum. Formation of the testes is the first step. Once this is done, the testes produce the male hormones that begin acting early on to bring about a male's development.

For example, the male hormone testosterone causes many basic structures to "masculinize" throughout life, usually by simply increasing or decreasing their growth. In fact, every part of the female has its counterpart in the male; it merely grows larger in one sex than it does in the other.

Not only do the male hormones cause the genitals and other physical structures to develop male characteristics, but they also cause minor differences in the central nervous system. This results in a set of sex-linked abilities and behaviors that are enhanced or suppressed as a result of the presence of male or female hormones.

The abilities that appear to be enhanced in women are perceptual speed, precision manual tasks, recall of visual markers, and verbal fluency. Men generally tend to be better at certain spatial tasks, finding and remembering their way through a maze, and on tests of mathematical reasoning. In fact, at the upper end of mathematical reasoning ability, males seem to outnumber females about 13 to one. Research is quite clear that these are genetic, and not cultural, differences. Culture, of course, creates differences of its own.

It should be emphasized that genetic differences correlating with some specific trait, such as sex, usually show **smaller** differences between **populations** than between the **individuals** within a single population. In other words, the difference between the average man and the average woman is **less** than the average difference among only men, or among only women. The degree of overlap is such that a few women do better than almost any given man on "masculine traits," and such that a few men do better than almost any given woman on "feminine traits."

## Stages of Development

At first, a baby has a sense of "infantile omnipotence." During its "terrible twos" this is put to the test as a child becomes disabused of this sense. Eventually the frightening awareness sets in that, far from being omnipotent, a child is totally dependent upon a world that it has very little control over. In the course of growing up, the child learns to model its behavior on that of adults whose wills can be manipulated only slightly and whose cooperation is necessary for any kind of well being, sometimes even life itself.

Each of us is born with a set of perceptive faculties and a brain to use and integrate them. We also develop the ability to initiate actions and bring about changes in the environment we continually

perceive. Not from instinct, but from a lack of experience and understanding, a baby or young child makes destructive changes at first. This begins with the consumption of food that enables the child to grow. All living things consume according to their needs and their capacities. But a child makes other changes and observes still more take place in the environment around him. These tests and observations form the basis for his learning. Learning involves both discrimination and generalization. We learn the similarities of different things, and the differences between similar things.

Sensation is the direct experience that results from an afferent, or incoming, nerve message as it arrives in the brain. We know that somatosensory receptors, ones at the surface of the body, connect to the brain at specific locations. Any direct stimulation of the brain in these areas (by implanted electrode) causes the sensation of touch on the respective area of one's body. This is true for sight, hearing, and all the senses. Sense organs are connected to the brain at specific locations. In the areas of the brain not specialized to a particular sensation even "forgotten memories" may be reactivated by direct stimulation. These may be memories of a whole collection of sensations, and are said to evoke the feeling of "being there."

Perception, on the other hand, results from the active combination and processing of sensations. It has to do with past experiences of similar sensations and the various things considered relevant at that time which went along with the past sensation. Sensation is based upon structure, both the structure of the actual receptors and of the nervous system itself. Perception is like a higher level sensation. Between these two, a process of integration takes place. At one end, integration is very mechanical and depends upon certain structures right within the nervous system, structures whose nature seems determined at birth. At the other end, integration occurs only as the result of a long and complex learning process. It may involve the cooperation of several areas of the brain.

The factors in human behavior again seem to lie on a continuum. At one end is tentative behavior in response to a set of ambiguous or never-before-experienced sensations. At the other end is behavior that is essentially a conditioned response to a set of very familiar cues. Now, our bodies and the structure of their sensory apparatus are designed to operate inside of fairly tight design limits. For instance, when we experience warm and cool differences on several parts of the body at once, we are likely to experience pain. This is because we are used to sensing a consistent temperature and then suppressing further notice if it stays within an agreeable range.

We are used to a certain volume of sensory input, and if deprived of it, experiments have indicated that we hallucinate and lose contact with reality very rapidly. These boundaries are easy to cross, and a person may react in an inappropriate, perhaps even a violent or psychopathic, way to an unfamiliar environment or situation.

Scientists who are advancing the frontiers of space or exploring the deep oceans are interested in this type of study so as to know how much familiarity must be maintained to keep the human explorer in good mental health as he journeys into the unknown.

The sensory mechanisms we possess seem to have a fairly limited range. Light, sound, temperature and all raw energy sources, capable of being sensed, are only sensed in a fairly narrow band of their full spectrums. Most environments, in fact, produce these energies in far wider bands than we can sense.

From studies made of the human brain and even more with animal's brains (the former presumably by accident, the latter by design) we have found that the destruction of a small area of one's brain may cause a very specific aspect of one's senses to be lost. Examples are touch in a certain area of the body, smell of a particular odor, and recognition of certain sounds or basic visual patterns. If a particular

area of the visual cortex is destroyed, a horizontal line may not be recognizable, even though rotation to the vertical can restore recognition. In some animals, certain of these integrative mechanisms are built in at the area of the receptor and neurons have been severed to produce the same results. Integrative mechanisms of this type seem to be directed by heredity just as, for example, the strength of one's bones. However, each depends upon exercise and use for the fulfillment of hereditary potential.

This ability to develop integrative mechanisms is another example of a continuum. The continuum begins at the peripheral receptors. This fact has been noted in relation to studies of the retina in cats and frogs. Further integration takes place in the specific areas of the brain devoted to particular senses. For example, the occipital lobe is one of the largest specific areas in man's brain. Its size demonstrates not only the importance of vision to us, but the number of integrative mechanisms we have developed there. At the other end of this continuum are faculties that cannot be lost by local destruction, but only with damage extensive enough to cover nearly all of a particular sensory area of the brain. For example, word recognition, either written (involving the visual area) or verbal (involving the speech area) is lost by **degrees** depending on the **amount** of the destroyed area.

Memory of an experience or of all the experiences comprising one's personal history seems to be very accurate and very complete, but for all practical purposes recollection of any but a very few experiences can only be stimulated by very strong associations. The storage of experience seems to be rather like the recording of a picture by a hologram. In other words, memory is not localized, but is spread out fairly evenly over several areas of the brain so that loss of brain tissue causes increasing inability to recall, but never the complete loss of a specific memory leaving a similar type of memory intact. Following an association that recalls a memory trace, we reconstruct a "complete" memory. This gives us the impression that the entire reconstruction has been remembered, while only the initial trace was actually valid.

Perception is a learned skill. It involves recognition, recall, and discrimination. As certain patterns become more important and we learn to separate these figures from their background, other figures and patterns must be suppressed. Learning one thing often blocks the ability to perceive other things.

When perception is operating effectively, it is like a radio tuned to a certain wavelength. In fact, the expression "tuned in" is often used in this context. For example we might say, "he is really tuned in to that football game," whether he is attending it in person or watching it on TV. Just as a radio tunes in to one wavelength by tuning out all others, a person narrows his perception from all of the sensations he receives, to that narrow band which interests him. Naturally this can lead to either isolation or knowledge depending on how this faculty is used.

If you are willing to "change stations" from time to time in order to get a rounded sample of what is being "broadcast" and to interact, instead of passively receiving, you stand a better chance of gaining knowledge and wisdom. If you merely "tune in" to what comforts you in order to escape, or receive a single "station" out of habit, or if you fail to interact with the ones you do receive, you will probably fail to develop your potential. Instead, you may remain unaware of what your sensations can really receive and what your perceptions are really capable of "tuning into."

How does understanding differ from perception? It is as far removed as perception is from sensation. Every baby is born into a world of sensation. From these it learns to synthesize patterns from pieces and distinguish patterns from backgrounds, beginning with hereditary abilities and extending to those learned with much practice. A child spends pretty much its whole childhood developing mechanisms for perception. Play is an activity which gives it a chance to interact and perfect its abilities to associate,

discriminate, and recognize. It also gives a child a chance to develop an imagination and some rudimentary skills.

A child soon learns one basic fact of life, perhaps so basic it never really becomes aware of it. A flower picked begins to wilt. Patience builds a tower of blocks slowly; carelessness knocks it down in an instant. A thorn pricks immediately, but the pain lingers on. A leaf or a petal once picked cannot be put back. Events like these define a direction with respect to time.

As it interacts with its environment, changing it usually for the worse, a child consumes things, changing itself usually for the better. First a newborn baby cries or gasps and, as a result, it consumes oxygen which it needs to live. Then it sucks and swallows milk, digesting it to help it grow. Later, it may take apart a toy to see how it was put together. The process of consumption is one that increases entropy in the environment in order to construct something else; at first this is the child's own body.

Learning is a part of growth, and each growth-step has two phases. The first is destructive in some sense, but the second phase must be constructive. Consumption combines both phases into one. Food is broken down soon after it is eaten, but it really hasn't been consumed until it has been put to use building tissue or giving up energy. Similarly, when a child takes apart a toy, the lesson has only been half learned until it can be put back together. As for picking a flower? This lesson may take us all a while to finish!

In this way, as you grow older, you assimilate the relationships around you, natural and cultural, and these help you grow in understanding. By learning how the many elements of your world relate to each other and interconnect, you develop the patience, wisdom, and courage necessary to make effective and constructive changes in the world as an adult.

Over time, we would expect a child to improve its performance and then level off in many different areas. However, knowledge can get ahead of common sense, and can actually counteract it. This causes the "U-Shaped Pitfall."

## The U-Shaped Pitfall

"A little knowledge is a dangerous thing." The U-Shaped Pitfall is the perfect example of this. The "U" refers to a performance graph with a serious dip in its middle.

The following example will show how this works. Keep in mind that this can happen to any of us at any stage of our lives. It happens, perhaps most obviously, to children, as this example shows. But, you could probably construct an example out of your own (recent?) experience to show that it can happen anytime we aren't careful.

The example: There are three groups of people, very young children, older children who have just learned arithmetic, and adults. They are given the following problem. "Here are two glasses of water. The water in this glass is at 50 degrees and the water in that glass is also at 50 degrees. Now, if you pour the water together, how many degrees of heat do you think it will measure?" Many young children do not understand the terms, of course, and are unable to give an answer at all. But many get the correct answer that two sources at equal temperatures will combine to produce the **same** temperature. Most adults are not fooled either. But, the recent accumulation of arithmetic knowledge often has the result that the middle group of children **add** the two temperatures, and give an answer of **100 degrees**.

This demonstrates logical reasoning versus *intuition*. Logical reasoning tends to be mechanical or rote. Intuition tends to involve more factors in parallel. A slide rule was difficult to learn how to use without having some approximate expectations in parallel with slipping the stick back and forth. It helped to use some intuitive reasoning. Modern calculators, on the other hand, especially those that keep intermediate results hidden until the "equals" button is pushed, invite a more mechanical approach. Here, a big mistake is often as easy to overlook as a very small one.

* * * * *

Many ladders of development that we each climb have been suggested. The steps on three of these ladders are as follows. They have to do with how we **view** others, how we **use** others, and how well we **know ourselves**.

**Our View of Others**

1. "Infantile omnipotence." The newborn's belief that the world and other people exist only to serve and gratify it.

2. Fear of complete impotence. The realization that the world and other people are totally out of one's control and also that one is completely at their mercy.

3. The effective supplicant. Young adults seeking role models or relationships that offer them a "leg up" on life.

4. The successful negotiator. A more experienced adult able to use others, both older and younger, in "positive sum" interactions.

**How We Use Others**

1. Our profit comes at others' expense.
2. Our profit comes at our own expense.
3. Our profit comes from our own success.
4. Our profit comes from the success of others.

**The four stages of knowledge**

1. Those who don't know, and don't know they don't know.
2. Those who don't know, but know they don't know.
3. Those who know, but don't know they know.
4. Those who know, and know they know.

## These are the Years of Our Lives

0-3 Development of basic faculties
4-7 Development of skills, verbal and visual
8-11 Rote learning, drill, and memorization
12-15 Problem solving and learning to think
16-19 Specialization
20-23 Mastery and entry into adulthood

24-27 Entry into a career
28-31 The “major accomplishment”
32-47 The “productive” years
48-63 The second “wave”
64-79 The harvest
80-95 Reflections

# Creation

The cycle of birth, development, and procreation could be called an “inner cycle” of *creation*. Creation is a process whereby the absolutely new comes into being. There are three ways that it can be imagined. First, an event like the “big bang” where all (or a lot) of the matter in the universe suddenly comes into being. Second, the sudden appearance of some object, the likes of which, and the substance of which, have never been seen before. And, third, matter that already exists is fashioned into a form using a copying process. Any of these could involve divine creation, but only the last involves evolution.

No instance of either of the first two has ever been documented. So, only the third will be explored here in more detail. Some might question whether this is creation at all. Hopefully, the discussion will answer this question. Others might insist that the **existence** of the cosmos is **proof** of one of the other types of creation.

However, it’s not proof, since two other possibilities exist. One possibility is that the cosmos is **without** beginning or end. In this case no creation needs to be explained. The other possibility is that both the plan and the material for the cosmos could have existed (in some sense) **before** the big bang and **that** could have been a copying process. However, the focus of this book is on **human** reality, so further discussion of these other possibilities is postponed to another book.

The third type of creation includes events of chance and necessity that **lead up** to the existence of life, the **procreation** of living things, and the creation of **artifacts** by living things.

An act of creation by a living entity is related to the principles of evolution. Creation can occur by accident or by intention. Here, we will focus on intention (this is an instruction manual, after all!), and as a part of one of the following activities: Design, growth, performance, and discovery. How each of these relates to evolution will then be summarized.

## Design

Design is a concept with two aspects (a word that is both a noun and a verb): A thing, and an activity. The activity of design produces a design as its result. Without question, creativity is involved. Design is a creative activity, and a design is a creation.

The activity of design is a also a copying process, perhaps to a greater extent than it is a creative one. Standards, rules, and procedures are used. Examples and prototypes guide much of the design process. Little of almost every resulting design is wholly new. Even if the resulting whole has never been seen before, its parts almost certainly have.

The Fundamental Principles of Design:

1. Keep it simple — components, connections, concept.
2. Go with the flow — Nature, trends, human factors.
3. Consider the life cycle — production, numbers, support, and disposal.

Finally, design is a process of incorporating intention into form, of relating means and methods to goals and results. Design is an activity that describes; it is engineering, craftsmanship, and art. A design can be expressed in three forms: In its final form, as an object unto itself; in an intermediate form, as a model or plan of the final form; or, as a recipe or procedure that describes how to construct the final form.

## Growth

Growth is a class of processes that certain things take part in. This process may be one of accretion or crystallization, or it may be more complex: It may be one of building or assembly.

Growth may follow a design or it may evolve without a plan. Growth that follows the more simple process of accretion or crystallization may combine homogeneous or heterogeneous constituents. Growth that **follows** a plan may, of course, may not always **go** according to the plan.

Whether growth departs from a plan, or never had one, it generally reaches a catastrophe point if it goes on long enough. Over the shorter term, growth follows some kind of "curve." Common growth curves are linear, exponential, "S" curves, and "humps." An "S" curve, by the way, is best seen as an "S" stretched sideways a bit. Picture taking hold of the "S" at the bottom left and top right and pulling it apart until the middle part of the "S" rotates from its 10 o'clock position around to about 2 o'clock. The different curves come about in the following ways.

Linear growth occurs at a constant rate, kind of like the amount of sand in the bottom of an hour glass. Very few things in nature grow at a constant rate. A linear growth curve is simply a straight line slanted up and to the right when drawn as a graph. Growth curves chart size on the vertical axis (height from the bottom of the page), and time on the horizontal axis (distance from the left side of the page). The starting size and time (usually zero) is at the lower, left corner of the graph. Growth over time is usually depicted as a line that wends its way upward and to the right. The course that it follows is called a "curve" whether it is a straight line or not.

Exponential growth usually implies a feedback relation between the current size of the thing growing and its rate of growth. Positive exponential growth means that the bigger something is, the faster it gets bigger. Many things in nature grow this way, at least if they can! Negative exponential growth means that the larger something is, the slower it grows. A positive exponential growth curve starts out flat and gradually turns up. However, it never quite goes straight up. A negative exponential growth curve does start out going straight up, but it curves more and more to the right, never quite becoming flat, but always becoming more flat.

Growth on an "S curve" may simply be positive exponential growth followed, at some point, by negative exponential growth. In this case, growth is unbounded, it goes on forever, but ever more slowly. The more common "S curve" is one in which growth starts off slowly, gains speed, reaches some maximum rate, then begins to lose speed and approach a maximum size as a limit. This curve is often used in economics and it is a good approximation to many natural growth processes. It describes the growth of most animals, for example.

The final growth curve is the “hump.” It looks like an upside down “U.” Growth starts from zero, the entity reaches some maximum size, then it diminishes back to zero. This curve seldom describes a living entity. It describes things like a population with a limited food supply. When the food runs out, the population dies off.

Certain questions about growth need to be asked. How does growth relate to creation? How does growth relate to catastrophe? What is the opposite of growth? Consider: Growth involves an entity of some type. An entity that grows, at some point **starts** to grow and at some later point **stops** growing. The starting point relates to creation; the stopping point relates to catastrophe.

The opposite to growth by accretion is something like loss through attrition. Some things wax and wane, expand and contract, grow and shrink. However, only very simple growth processes can be reversed. We can see the intuitive relation between growth stopping and death, and between death and the notion of catastrophe. But catastrophe has been given a more technical definition that does not imply only calamity and disaster, it may correspond to any kind of discontinuity or inflection point in a growth curve. The types of catastrophe are as varied as the types of growth themselves. Virtually every type of growth process may encounter one or more types of catastrophe, not all of which may ever be known. An example is the growth of a star by accretion; at some point gravitational collapse causes a radical change, and its growth curve becomes a “hump.” *Catastrophe Theory* is all about the various kinds of “straws breaking camels’ backs.”

## Discovery

One way to discover something is to simply recognize it around a literal or figurative corner that no one else has turned. Invention occurs when the *discovery* is **suspected** around the corner. The chances of discovery are increased by **active** search (turning more corners).

Chance and necessity are the “father and mother” of discovery. Trial-and-error is what keeps them active. Insight and perception are the ingredients that induce them to make magic.

Discovery, invention, and the results of applied creativity are all closely related. The word “discover” implies that a cover is simply taken off of something that already existed, but this is an artifact of our history, a notion handed down to us by those who first used the word “discover.” The concept has been extended from discovery of new islands, continents, and chemical elements to that of bringing an absolutely new arrangement of matter, process, or information into existence. Most discoveries represent only small steps, large discoveries are rare. However, all discoveries have some utility that causes them to be selected out of the many novel events that occur. This utility is confirmed when, having been selected, a discovery is copied and propagated.

Discovery is generally a leap rather than a gradual unfolding. It is a part of the evolutionary process, but when it involves intelligence, the process is greatly amplified.

## Evolution

Evolution results in creation. Design, growth, and discovery are parts of the evolutionary process. All types of creation and all creative acts occur using some or all of the principles of design, growth, and discovery.

To understand evolution is to be clear about what it does and does not entail. To do this, let's classify the **behavior** of all things onto four levels: mechanical, statistical, chaotic, and living.

Evolution does not describe a process of simple or *mechanical* operation. An illustration is the science of physics. Machines operate according to the principles of physics. When things are simple enough, they behave in a mechanical way. Things become more complex as more and more components are brought into interaction with each other. In some cases, the behavior of such a system can be described quite well enough with statistics. In other cases, the behavior becomes chaotic, often in unique and different ways for each complex system that we discover.

The chaotic evolution of a non-living system is like the evolution of a hurricane. A pattern is present, behavior remains within certain predictable limits, the pattern endures for a time, neither collapsing nor exploding, but within its limits it is fundamentally unpredictable. The systems that were the precursors of life were much smaller than a hurricane, and they evolved over a much longer period of time. Their evolution involved the chaotic recombination of initially simple, but increasingly complex, systems of organic molecules. As these systems interacted, new forms and structures arose from them.

The term evolution may be used in a fuzzy, non-technical sense to describe the long term behavior of all of these types of systems — mechanical, statistical, and chaotic — but, applied to life, it is used in a more technical and well-defined sense.

Living entities are beyond a critical threshold of complexity. They behave according to principles that are more than mechanical and different from chaotic. A single living entity grows and develops, it does not evolve. It unfolds according to a plan. It is this **plan** that evolves over the course of generations.

Some of the things that evolve are form, function, and knowledge. Form describes shape and physical pattern. Function involves the notions of purpose, skill, performance, and relation. Function relates form to knowledge. Knowledge records the patterns of form and function. Form, function, and knowledge are closely related to existence, interaction, and information. So, if we wish to know, "what kind of **thing** evolves?" The answer is: "**Reality** evolves."

## Becoming a Parent

Becoming a *parent* is one way to copy and pass on the legacy we have received. Parents have an obligation to the new lives they begin. This obligation is fulfilled by exercising degrees of control. From the moment of conception to the moment a child becomes an adult, the degree of control a parent may exercise over a child diminishes from absolute to nominal. This "control" is the parent's right. In other words, parents have the right of life and death over their progeny at the moment of conception, and no more rights when their offspring become adults than those appropriate to other adults.

Let's take a brief digression here to discuss these issues. Duty was mentioned in the last chapter and some readers may have taken issue with the treatment it received. The concept of duty may be unacceptable to them. It may be dismissed out of hand. Others may believe in duty and consider it to be handed down by God. The duty of many is accepted as a part of being empowered by those who hold power over them. Duty is part of our *ancient covenant*; it cannot be dismissed out of hand. The concept of duty is very old, it has evolved over very long ages. If we are to repair the pieces of our ancient covenant and begin to form a new one, there is no better place to start than with the concept of duty. Just as it cannot be dismissed out of hand, it is no longer sufficient to see it as God-given. Duty must now be defined as part of a covenant we keep with each other.

Duty may be nowhere more apparent than where it involves passing on our legacy. Each of us is what we are because of the legacy we have received. Each of us has the right to pass on what we can. When we choose to exercise that right, we have to assume the duties that go with the job. Duty implies two things: Being **able** to perform, and being **concerned** with the result.

## A Parent's Rights

Let's continue now with the process of becoming a parent. The rights and duties of a parent relate to the stage of a child's development. This process begins when the parents decide to have a child; the parents literally have the right of life and death. The process ends when rights and duties are no longer appropriate, and the child has become an adult blood relative. Given these endpoints, there is a range of acceptable control that corresponds to the stage of an offspring's development. The acceptable at one point may not be acceptable at another, but no distinct lines are crossed. The acceptable **fades** into the unacceptable, unlike a light that suddenly changes from green to red.

This principle governs everything from decisions about whether to begin or end the life of a fetus, to the practices of child rearing, discipline, selection of health care, and the curriculum of formal education. It is very important to understand the stages of fetal and child development, the duty one has, and the latitude of choice one may exercise.

Our growth process, our ontogeny, follows the course that evolution took in bringing us here. For example, we develop from a one-celled animal through various stages that resemble ancient lifeforms. At one point a human fetus appears to have gills like a fish. Various organs are developed by the fetus in the same order that they were evolved over the course of history. Likewise, after a child is born, social development occurs. The most natural development of a child's social skills follows a course similar to that of mankind's social evolution over the past million years.

## A Parent's Duty

The fetus and the child should be regarded and treated in accordance with its stage of development. What is acceptable behavior toward a single-celled animal, a fish, or a primitive savage, is a guide to what is acceptable behavior toward one's offspring at various stages in its development. Our physical growth, from fertilized egg to adult, mimics the course of our evolution. In other words, as we learned to say in college,

Ontogeny recapitulates phylogeny

Physical growth copies evolutionary development. And, since this idea seems to work, it seems natural to guide social development along the lines that human society evolved. In fact, physical and social development are not well defined as separate concepts. What we are really concerned with is the development of the brain and mind. This development involves physical growth along with mental learning, highly interrelated processes.

It may be evidence of how the final stages of our own evolution progressed that the final wiring of our brain, its final spurt of growth, and the development of our vocal tract all occur about the same time — right after we are born. Only **after** we are born, does the slightly dangerous modification of our pharynx take place to support speech. Our voice box descends relative to our throat, making speech possible, but making it impossible to breathe and swallow at the same time without choking. For the first six months of its life, a baby is spared this danger. It can breathe and swallow at the same time. But, when

the pharynx is modified to make speech possible, this ability is lost. After about six months, we choke when we try to breathe and swallow at the same time. It's a transition to watch out for in a baby.

All development follows a natural sequence. That which may be appropriate to one step in the sequence may be inappropriate to another. Something missing at the exact time it's needed can inhibit development and leave a permanent deficit. A strong and **inappropriate** influence at a critical moment can also leave a permanent effect.

A very simple illustration is an experiment that has been performed on kittens. There is a critical stage (a period of hours, a few days at most) in a kitten's development when it forms the "circuits" for its vision. If it is kept in an environment without horizontal lines, it simply doesn't learn **how to see** horizontal lines. After this stage is passed, if such a cat meets with the edge of a table, for example, it is likely to fall right off, because it literally can't see it.

People who were born and grew up blind have occasionally had their sight restored by an operation in later life. Invariably this leaves them with visual deficits that they can never overcome.

So, how do these principles translate into instructions for raising children? First, be sure you understand the principles. There will be a lot of unique situations and there are hundreds of alternatives that are advocated by some authority or other. If there is a long tradition or thousands of years of accepted practice for a thing, you won't be making too big a mistake in following it (unless there is a recent law against it).

If you follow a new technique, you are performing an experiment. Some people would rather limit the amount of experimentation they perform on their own children. Don't be misled by the desire for the newest and best for your children, the newest may not be the best. For example, it has "recently" been discovered that breast feeding is better for a baby than formula from a bottle.

If you follow outmoded or other parochial techniques, you run the risk of denying an important improvement or advantage to your child that other children will grow up having. On the other hand, the new technique may be just a fad, offering no real advantage. Use your knowledge and judgement to decide. Try to understand the principles offered here. Fall back on tradition when things seem unclear. In either case, whether you choose a new technique or an old one, the **choice** should be **yours** to make.

Babies need fondling and stimulation. They need to see their parent's faces and hear their parent's voices. They need to develop eye, hand, and body coordination. They need simple objects to manipulate. For the first year or so, babies need a **lot** of their **mother's** time. Direct interaction with a father is good, but not essential. What **is** essential is how a child's mother and father interact with **each other**. This forms a child's primary role model.

A child has a drive to get attention, respect, and love as it grows up and develops the capacity for each of these in turn. Momentary suspension of these, not anger or hitting, is nearly always an adequate punishment for bad behavior. Simple object lessons are even better. The child needs to feel that its drives are satisfied by the result of its own actions in cooperation with others.

A sequence of things important to a baby goes as follows: Breast feeding, fondling, grasping, seeing faces (parents first and most) and other things and colors, eye-hand play, hearing words and verbal interactive play, crawling, moving about, and having a space to explore and discover.

As a child grows up, stories, fables, and actual participation in ritual are important. Play is very important to learn the rules of games, the spirit of competition, and the adoption of various social frameworks, roles, and scripts. All of these build a child's social repertoire.

A child needs to build an intellectual repertoire as well. Between the ages of four and twelve, this is largely skill based. Reading, writing, and arithmetic are skills to be learned, just like playing complicated games.

Sometime around the age of 12, ritual and rules need to give way to thinking and solving problems on the child's own. Both puzzles and moral dilemmas should occupy much of the next four to eight years. This is also the time to review what humanity has learned during its recorded history: Science, literature (including myth, philosophy, and religion), art and music, and past civilizations. Simple exposure is not enough. The child needs to be **involved** and to **experience** these things, not just learn some facts about them.

A world class talent is usually nurtured and developed starting between the ages of four and twelve. If a child shows a particular interest in a sport, musical instrument, or academic subject during these ages, great. However, it is more the norm to have a moving interest over a variety of activities than to have a deep fixation on just one. It is also better grounds for survival in adulthood. For every actor, standup comic, football or tennis player who gets paid the big bucks, there are hundreds who barely get by and eventually have to turn to other jobs.

How can we assure that our offspring and others grow up in the best way possible? We can be role models for them and see that they have the **opportunity** to be like us. If we are not the models of what we want others to be, or if others are denied the raw materials of nutrition and knowledge, then we cannot progress as a species. As a society it is our *duty* to provide these basics and encourage people to accept the risks of life, earn their own way, and leave a little more behind them than they consume while they are here.

## A Good Parent is a Good Leader

The two most important things to know, whether you want to be a good parent or a good leader, are respect and clarity. Never talk down to a child or to a subordinate. You are in control, so stay in control. Never lose your temper, but be sure the other person knows that you have feelings too. If a confrontation begins to develop, try to keep feelings out of it and put the pertinent objectives and rules in the forefront. Discuss these and work out a logical way to follow the rules and achieve the objective. Maintain your position of authority, but make sure the other person knows that you respect them as a human being with dignity and rights equal to yours.

The second principle, clarity, is necessary to make the first one work. You must lay some groundwork in advance. Have a set of rules. Don't be a fanatic about them, but follow and enforce them except on extraordinary occasions. Try not to be capricious about bending the rules. Make it known in advance what the new plan is when the rules are temporarily or permanently being changed.

Clarity is both for making rules and for normal communication. The best way to be clear is to think before speaking. Reflex speech is often just an angry reaction. By thinking first, you avoid anger and other negative messages as well.

If you treat children the way you treat subordinates, and you treat both with clarity and respect, you will be successful. If you treat subordinates as children, or mix emotions into your interactions, you will be

less successful. Don't be capricious. Don't hesitate. Don't be "bossy." Be in control. Be firm. Be predictable.

Your attitude determines how you treat people. How you treat them determines how effective you will be. The best basis for the "right attitude" is to believe certain things about other people. Many of the things you believe will be "self-fulfilling prophesies." Over the long run, this is especially true of children. If you aren't the role model of what you want your children to be, they stand a very small chance of becoming it. This is true to a lesser extent of everyone else with whom you interact. But your attitude, how others think you regard them, is most important.

People want to help. They want to be part of the team and be valued for their contribution. People have individual differences, but they share to some degree every human characteristic and have some degree of every human strength and weakness. If you make this your stereotype of people, rather than some set of faults, you will have higher expectations of people, and they will tend to meet them.

There are four types of people that you need to control, some very often, some only occasionally. These are your children, people who work for you, people performing a service for you, and other close friends and members of the family. With all but the latter, you are in a position of authority. It is important to merit and maintain your authority. The very best way to learn how to do anything is to pattern your behavior after someone who already does it well. Good role models may be hard to find. Seek them out.

A poor role model is someone patterned after poor role models. You know who they are. It is someone's great good fortune to have good role models in their environment when they grow up, and a great misfortune to have none. If you remain unconscious of this, you will be at the mercy of fortune, either good or bad. But, if you think about it, you can tell a good role model from a bad one, and you can seek out what you need. Ultimately, you should strive to be a good role model for others.

## Six Rules for Raising Children

The following rules summarize the above discussion. Raising children involves a lot of common sense and a very few rules. Mistakes that you make, especially if they are part of a pattern, will probably be incorporated into the way that your children will one day raise your grandchildren.

1. Be clear and firm, not hesitant, in expressing your rules and your wishes.
2. Be a respected friend and ask for cooperation on that basis, rather than scolding or hitting.
3. See that children participate in household chores and in decisions that affect them to the degree they are able.
4. Enjoy your children and let them know that you do.
5. Communicate with your children; let your communication with other **adults** be the model you wish your children to copy.
6. Punishment is a last resort. It should literally hurt you worse than the child; if not, it's called retaliation, or, worse yet, abuse.

## The Modern Family

The phrase, “the modern family,” means different fragments of what used to be “the family.” In times past, a family was an **extended** family. In times **long** past, it was a tribe.

A family properly contains at least one child. Without a child, two people can live together as a couple, but a discussion of couples will not be taken up here. The different forms of the modern family are whatever living arrangements you can find under a single roof that also shelters one or more children. It can be the traditional “nuclear family” headed by both a mother and a father, or it can be a “single parent family” headed by one or the other. Single parent families differ on the basis of what happened to the missing parent (dead, disappeared, or divorced), and what stage in the life of the child that parent became missing. Other possibilities for a family are the commune, some combination of relatives other than parents that raise a child, adoptive families, and institutions.

The mere presence of a mother, a father, and 1.2 siblings in a child’s environment is not important for ideal development. But, **ideal development is** the issue here. This is the purpose of a family. Anything else is simply a living arrangement between two adults. Given the purpose of the family, what are the factors that make an environment ideal for a child’s development?

Some of these are discussed in the next section. Some directly relate to “the modern family.” A loving, caring mother is the most important thing to a newborn baby. An “ideal” mother and father are the “best” basis for a family. However, not every child is born to the ideal parents. The presence of a bad enough father or mother can be worse than his or her absence.

Parents themselves have the right to make the choice, even if they sometimes need to seek outside help. Misfortune may intervene and cause a less-than-ideal family unit. The principles to be followed then, are that the family unit exists to raise children. Substitute family units should attempt to copy the “ideal” as best they can.

## Development

The needs of a child in relation to its family environment and the early attention it gets from its parents, especially its mother, are discussed above. Three themes are important: Stimuli, security, and role models. Direct interaction and attention given to a baby, and the environment of a child are the source of the stimuli that are important to its early mental development. Security refers to stable social relationships, adequate nourishment, shelter, and protection from other threats. Role models are important to a child’s social development. The ultimate responsibility, and many of the most important duties, of raising a child belong to its parents. However, the child will one day become an adult, enter society, and be responsible for himself. Therefore, other entities besides parents have a right and a duty to take certain interests in a child’s development.

## Schools & Education

As first the tribe, and then the extended family, broke up, schools and formal education had to be instituted to replace these lost functions in the raising of children. When a child first enters school (and this should probably occur at the age of three, rather than six), education is only secondary — two other functions are primary. Most important is creating a context for children to interact with each other. In

today's world it's also important to off-load some of the parents' time so that continuity can be maintained in their jobs or careers.

*Schools* are simply buildings where education takes place. *Education* is a process of students interacting with teachers and each other.

There are some things to strive for and some things to avoid in the educational process. Since education is usually provided by an institution, these may not be under a parent's direct control.

Regimentation is not particularly good, but conformity to a plan or tradition is much better than having either a child or a parent determine the contents of an education. A system that is responsive to a child's needs is best; one that is not, is still better than letting a child choose his own curriculum.

There are several things that need to be done to modern education. Parents should exert the effort that will help bring these things about. Currently, we have day-care for preschoolers and thirteen years of public school (in the United States). Public school takes up little more than six hours a day, five days a week, for nine months of the year. A resident of the United States has the right to attend public school, but not day-care. What's wrong with this system?

First, it needs to be able to cover more time. Public school needs to start at the age of three. Instead of thirteen years, sixteen are needed. Second, public schools should house three functions, not just one mélange. A core curriculum of math, science, government, technology, and social skills should be standardized. Special activities of play, problem solving, and competition should be offered at the student's choice. Finally, parents should be able to choose a program of arts, humanities, history, religion, and other subjects that conform to the cultural or ethnic tradition of their choice. The fewer the teachers and rearrangements of the students, the better. The longer and more stable the relationships between students and their teachers the better.

Schools need to be provided by the state. They consist of shelter and supplies. Schools need to provide classrooms for classes of different types and sizes. They need to provide administration to handle scheduling, payroll, mediation between parent and teacher, and general facilities support. Private interests should fund the research and development of all but the core curriculum. Public funds should be used to update the core curriculum.

Parents need to be more involved and interact with their child's teachers. Teachers need full time jobs. Students need full time schools. Teachers need time to prepare, time for interaction with other teachers and to get updates in their own education, time with the students, and time with the parents of their students. Parents should spend at least an hour a month in a class with each of their children's teachers. The teacher should describe the lesson plans and allow feedback. The parents, by themselves, should discuss the teacher and essentially, by committee, perform the teacher's review and provide it to the school administration. The hiring, firing, and promotion of teachers should be based on this review.

What are the major differences between the program outlined here and the current system? The system we should strive for would cover a forty hour week, twelve months a year, and ages three through 18. All functions would occur under one roof with a number of separate classrooms and teachers. Teachers would be responsible to parents. Administrators would be few in number and responsible only for physical support functions. A child might have several teachers in a given day, but the same teachers and classes might remain together for several years. Children of all ages would be

taught under a single roof. Classes could contain children of different ages, and different curricula could divide the age groups differently.

With the wider coverage of this system, a certain flexibility should be granted. Enrollment should not be mandatory until about age six. It should be possible to pull a child out of school for a maximum of three months each year.

Schools should serve a community of parents. There is no need for students of different ages to go to physically different schools, or to need transportation across a city between activities. A single, physical location should provide all the ethnic and recreational support demanded by the parents of a community. If it couldn't, a parent would have three choices: Move elsewhere, raise the money, or forego the activity. The need to provide communities with equal opportunity schools should be met by the government. This role should involve providing referees and salary differentials to insure that all schools provide equal opportunities to learn.

A major difference between the status quo and the suggestions here is that schools would no longer be the least common denominator of education, carefully avoiding all religious and ethnic subjects except in politically correct proportions. Tax money would provide a standard facility, support, and teacher's pay. Parents could go beyond this with whatever they wished. A complete curriculum based on the standards of the country needs to be available if any parent in a community requests it. This would be the first priority of a school's budget. Apart from this, the parents of a community should direct their own school by the control and interaction they have with their own teachers. Finally, schools (roofs over education) need to be small, proximate, and for all ages, not large, distant, and limited to a single age group. Another improvement to modern education would be the incorporation of more apprenticeships.

## Apprenticeships

During the second twelve years of a person's life, the best plan for their development might be an apprenticeship. Time away from school during Recreation or Culture, but not during Core, would be possible between the ages of twelve and eighteen. Between these ages, the apprenticeship could be served at school, or at another location. After the age of eighteen, the school would not be available.

The *master-apprentice* relationship is similar to that between a teacher and a student, except for two things. It implies greater depth and specialty. And, it takes place in the "real world." An apprenticeship is a bridge between school and a career. It is only appropriate when the choice of a career has been made. A master may pay an apprentice and has the right to an apprentice's work. An apprenticeship is generally part of a business. Work is performed that has monetary value.

## Self-growth

At some point in his development a person needs to guide his own growth and education. He may still need a teacher or a master, but his parents no longer have the right, nor the duty, to make the choices. At this point a child is on the threshold of adulthood.

The options in present society are to join the army, go to college, get a full time job, or hang out with the gang. We should make more options available. Vocational-technical schools, combined with a better system of apprenticeship, should be improved and expanded. Another option would be to expand the armed forces into a job corps that could handle unskilled work that the government is already charged with.

The period covered by self-growth begins at the end of childhood and ends at death. When people stop growing altogether, they begin to die. Self-growth is one of the things this book is all about.

## Government's Role

The role of government in the development of the individual has been alluded to several times. Here it will be spelled out. Government should be involved only where it is needed. It needs to do both a little more and a lot less than it does today.

Government should act as a referee and a provider. It should not be a decision maker. It should collect and disburse funds and enforce some rules about how the funds are spent, but it should not direct operations. Decisions should be pushed as far down as they will go, to the individual if possible, to the local or state governments when appropriate.

Certain aspects of education can benefit from economies of scale. Government should assist communities in receiving this benefit. Other aspects of education should be standardized across the country at large. The government should referee these aspects so that standards are **available**, but not mandated, to everyone.

Finally, for those who can't find them elsewhere, the government should provide jobs for the jobless and homes for the homeless. Some of the functions that could be performed by this type of government employee might be road work, national defense, work in public parks, public land, and other public institutions.

* * * * *

The reality we are most interested in here is the reality of the society of man. The principles by which this reality will evolve have been discussed. Guidelines for the lives of human beings, the driving components of this evolution, have also been discussed. In the next chapter, we will find out more about how to get involved.

Individual human beings may be the components of society and the agents of its change, but society as a whole is not an organism, and individuals are neither the direct agents of change within society, nor the largest components in its makeup. Individuals are the building blocks of institutions, and institutions are the building blocks of society.

The tribes and extended families of several thousand years ago have given way to a much more diverse, but at the same time, a much more organized collection of social entities. An *institution* is a collection of people organized according to some social design. An institution has a membership, a power structure, rules, and traditions. An institution is born of a design and dies when it has too few members or too little power, when its rules are no longer effective, when its traditions have been forgotten, or when one or all of these is destroyed by force.

An institution, like any entity that evolves, comes into existence as part of a copying process. The design for a new institution is based on the design of present and past institutions. The birth of an institution, besides being based on a design, involves a group of founders, a small collection of **people**. As an institution grows, it collects more and more people. Institutions may be more or less formal, more or less based on a rigid adherence to a set of rules and traditions. But, basically, any group of two or more people, even a couple living together, or a family group, is an institution if it conforms to the definition given above. The key to getting involved, is getting involved in one or more **institutions**.

# VI. Getting Involved

Let's say you've followed these ideas and instructions so far. You're a rational humanist who understands and accepts the scientific method as far as it goes. You're a skeptic, but not a cynic. You know how to take care of yourself. You enjoy life, and perhaps you want to make your mark on the world.

As you get your own life under control, you may take an interest in areas that are largely under the control of others. Sooner or later you may confront politics or religion as a social **force**, not just as an individual **choice**. You may discover that a rigid matrix of "correctness" is woven around the members of all societies to keep individuals in their "place." This can be an obstacle to living a life of freedom and self-determination. At the very least, this force is one to be reckoned with.

A prominent scientist recently made the observation,

> Honesty doesn't get you very far in science. You're much better off to say what's popular. The art of the scientist now is not so much to pursue the truth, but to pretend to pursue the truth and to get enough votes, get enough followers who agree.
>
> Virologist, Peter Duesberg

This sentiment echoes the expressions of free thinking men and women throughout history when they have found themselves in opposition to the establishment. The reason people feel disconnected from the political process is because they are! Success in modern politics seems to require a complete willingness to prostitute oneself to the process. This is precisely what must be learned to become a master in the craft of power. Even those who remain at some distance from the process are generally quite aware of what is currently "politically correct" and "incorrect." Violation of the latest (or local) standards of behavior is a risk of ostracism, unemployment, or even incarceration.

Up to now we've examined the principles of evolution, science, and the logical side of how people "work." Now for a "reality check." Why are politics and religion such touchy subjects?

Life is a struggle. Some have called this a struggle between the sacred and the profane. Others prefer more imagery: "being torn between the devil and the deep blue sea." Some connection with our deeper needs must be responsible for our acceptance of the trendy and politically correct. We tend to be drawn into their embrace, sometimes until we are in over our heads. Religion and politics resonate with a deep need for security. But why cloak oneself in a **straitjacket**, when a protective vest is needed?

In this chapter we will try to understand the nature of the social forces that keep individuals in check. We will look at the pieces of our ancient covenant. We will take a brief look at its relation to the development of political institutions through the phases of mysticism and the occult, religion, and various forms of government.

There are two aspects to what this chapter is about. First we need to understand how an individual might resonate with the illogic of crowds, and how illogic, both individual and collective, is brought about.

We will approach this with a discussion of some of the ancient and religious beliefs that bind people into groups.

Then, some examples of problems with government and society are presented. The institution is the basic building block that we can work with, and social design is discussed in terms of affecting the evolution of institutions. The purpose of getting involved is to effect change. All of us have some urge to do this, and there has never been a time in man's history when change was so critical. It should not be our purpose merely to be an instrument of change, but to be a part of effective and constructive change.

## Religion

While science is concerned with how and why things work, philosophy is concerned with origins and destinies, with the general causes and laws of reality. Religions have traditionally drawn from (or have influenced) philosophy, science, art, and other aspects of society. Often, religions tie into government. Religions provide a social gathering place and a concern for social welfare.

Religions and philosophies play a very important part in the evolution of our society. An individual inherits genetic material from the human population, but beyond that our heritage includes all the wisdom, knowledge, technical know how, art, and much more, that our species has evolved over the past many thousands of years.

Many of the historical concerns of religion have been taken up today by other social institutions. We've found the separation of church and state to be an excellent idea. Although unable to shoulder the entire burden of social welfare, churches do play a valuable role. This role may not always be identical to their mission, which is to provide a gathering place, and propagate and follow their dogma.

The dogma of a religion generally includes philosophy and morality. It provides the big answers to "Why are we here?" "Where did we come from?" "How are we supposed to live?" "What happens if we don't." However, this book is not the place for a review of current religions and philosophies, it is more of a (mutant?) offspring.

The positions taken and the choices made here were carefully chosen from the vast landscape of modern ideas, from both religion and philosophy. A copying process was involved, and an entity, a body of ideas, is the result you see here.

The long answers to the above questions are only understood through years of living. Here are some short answers that can be "tried on for size" until longer answers reveal themselves. Of course, answers can be accepted or rejected without question or effort to understand.

Q: Why are we here?
A: We are here to fulfill our destiny.

Q: Where did we come from?
A: We came from our parents.

Q: How are we supposed to live?
A: We're supposed to choose role models and pattern ourselves after them.

Q: What happens if we don't?
A: We will never fulfill our destiny.

Q: Is there a God?
A: If there is, our realities have little connection.

Q: What about heaven and hell?
A: We have everything we need to make these for ourselves.

Q: What about an afterlife?
A: What about an afterlife?

For such big questions, these seem like pretty small answers. But, keep in mind that living, not reading, is where real answers come from. The answers you see above reflect the fact that several of these questions invite nothing but circular reasoning. There simply isn't much, outside of building a tautology, that we can **do** with the questions about God and an afterlife. The questions about heaven, hell, and destiny are much more pertinent, but they are much more subtle as well.

The position taken here is **not** inconsistent with a belief in God or an afterlife, but it **is opposed** to using either of these as the reason or excuse for the choices you make. For example, the reason you should try to do good is **not** to earn a reward in the afterlife. And, similarly it is **not** alright to do evil on the basis that God will forgive you. Good and evil are more complex than this, and the circumstances handed to you in life are far different than a test being conducted by God as an entrance examination to heaven.

It is not necessary to put aside any belief you may have in God or an afterlife to understand the principles being related here. It is only necessary that you accept the possibility of other reasons for moral behavior. Let's see if moral behavior has a basis in a more immediate reality, one clearly connected to life as we know it.

## Good and Evil

Good and evil are products of **intention**. Good does not require sacrifice, nor does evil imply profit. In fact, sacrifice can be simple misfortune. No good or evil is ever done by accident. An accident results in **fortune** or **misfortune**. Both intention and ultimate results must be correctly assessed to tell good from evil, or either from fortune and misfortune.

What does this mean? For one thing, it means that you should "walk at least a mile in someone else's shoes" before you make yourself the judge of their actions. What may appear on the surface to be good or bad could be quite the opposite if you knew more about it. There is always a margin of doubt. Something could be better or worse than it appears to you to be, in proportion to the knowledge you lack. It is customary to give someone the benefit of the doubt and assume that a gray area hides good intentions, not evil ones.

Many outcomes are the result of luck rather than intention. It is easy to confuse the two, and actually reward good fortune as if it resulted from good intentions. What's worse, the unfortunate are often punished. Knowing this, you should beware of **both** ends of this trap.

# Do You Believe in X?

Believe in what there is evidence to support. Be skeptical of fake or false evidence and unsupported claims. Finally, take a special approach when confronted by ill-supported claims. For example, there is no adequate evidence for reincarnation or any kind of an afterlife. So, any need to believe in them must come from within yourself. If **you** are the source of the need, **and** adopt the belief, be honest with yourself as to how your belief came about and what supports and motivates it.

Why believe in anything not supported by hard and proper evidence? Why not simply reserve your judgement? Your logic could run as follows: How much can it hurt to believe in God if there is no God? On the other hand, how much might it hurt **not** to believe, only to find out that He does exist, and furthermore that your belief in Him is very important to your ultimate salvation!?

This line of reasoning involves the following. It requires that the God, whose existence is unsupported by evidence, requires your faith in the absence of evidence. In other words, He requires faith and loyalty in place of a logical and scientific attitude. If your belief was simply based on a "How much could it hurt?" philosophy, wouldn't an omniscient God see through this hypocrisy?

There would appear to be three groups of people you could join:

1. Agnostics, believing in what is supported by the evidence and withholding judgement for other assertions, believing that all unsupported assertions are just undecided for the time being;
2. True believers, believing wholly and unquestioningly in some insufficiently supported dogma, or tautology; and,
3. False believers, hypocrites who, to some extent, harbor the sentiment that "it can't hurt to believe, but it may be the cause of everlasting damnation not to believe."

Perhaps no one would put **themselves** in the third category, but if you aren't clearly and comfortably in either of the first two, is there any alternative to the third?

What are the risks of being in each of these categories? If you do fall into category number (3), you are concerned about being on the right side of eternal damnation or salvation. You are not a "true" believer, but you feel that following the customs of religion and having a belief in God gives you a better chance of salvation than any other foundation that you might choose to build your life upon. The risk is that God might consider any element of hypocrisy to be more important than the beliefs and customs you are following "just in case." If any degree of hypocrisy is more damning than an equal degree of belief in the "right things" then which approach offers the best chance of **avoiding** hypocrisy?

In option (2), you run two risks. The first risk is that you are right about the faith, but wrong about the dogma. Most of the faithful in the world believe in a different dogma than yours, so you are certainly going against the crowd. The second risk is that you are right about the dogma, but wrong about the need for absolute faith. Here there is no downside risk of damnation, but there is the fact that your faith has kept you from thinking about and understanding many other important issues in life.

Option (1) is the correct choice if **either** of the following is acceptable to you.

> It is better to believe in a reality **consistent** with the scientific method than to base one's life and actions on a dogma that is tautological or requires faith in lieu of reason.

Or,

> A Supreme Being may well exist, but I do not believe that its nature, or the laws it would require me to adopt, would forbid me from following a rational approach to thought and action as advocated by science.

Some will find their way through the maze of this logic quite easily, others will not. The difficult part for some is the deeply ingrained conviction that the existence of a creator and higher authority over man is self-evident. Any thought that all things are not the product of a Creator, or that man could be the source of ultimate authority over himself, may be pure and simple blasphemy to some people. If this is the case, logic does not form their maze, nor does it offer a way out. Such people have their instructions; they will find little here beyond entertainment.

## The Anthropic Principle

Most people wonder about the amazing fact that our environment is so suitable for us. It almost seems that only God could have made this come about. However, if our understanding of the universe **permits** the existence of a solar system like ours, a planet like our Earth, and life capable of evolving the creatures (including ourselves) that we see around us, then the *Anthropic Principle* provides an explanation for the coincidences that must have occurred if these things were not brought about by divine intervention.

Our reality begins with the fact of our own existence. Clearly, given that we are here, we should be **very** surprised to discover anything in nature that is incompatible with that fact. Until better explanations come along for some of the seemingly incredible coincidences of nature, we should accept each one by reasoning that "it could not be very much otherwise, if it were, we simply wouldn't be here to know about it."

Examples of two scientific coincidences, and there are many others, are the strength of gravity and the abundance of carbon. Science has no good explanation for why gravity isn't stronger or weaker than it is, but if it were, it would make existence as we know it impossible. If a couple of the constants in the equations that describe nuclear fusion were just a tiny bit different, carbon would be a very rare element indeed, making carbon based life impossible.

Scientists have no theory as to why these constants have the values they do. They seem to have been determined completely by chance. Of course, if they were any different, we simply wouldn't **be here** to know about them. It could easily be argued that the Anthropic Principle is a stopgap and that science may someday discover a better "reason" for the value of such physical constants.

On the other hand, pure chance may be the only "reason" for a lot of things. In a universe of strange attractors, even pure chance may sort itself out into something unexpected and hard to explain. The following card tricks illustrate this idea on a very simple level.

> A pat hand in poker is a straight, a flush, a full house, or four of a kind. There are less than eight chances in a thousand of dealing five cards and getting a pat hand, and about 32 chances in a **trillion** of getting five in a row! Shuffle a poker deck and deal 25 cards. What are the odds that you can **arrange** these cards into not just one, but **five** pat hands? Try it! You should succeed **well over half** the time.
>
> Ask someone to **think** of a card without telling you, and then shuffle and cut the deck. They should hold the deck face down and deal the cards onto the table face up in cycles of one to ten

cards each. The first cycle is determined by their secret card. Aces count as one, twos through tens count as their face value, and all face cards count as five. The final card turned over in each cycle is the count for the next cycle. They are to keep dealing until all the cards are turned over. Their "secret" **result** is the card that begins the final count. You can determine their "secret" result by following the same procedure. The odds are, **no matter what card** you each pick to **start** with, you will both lock on to the **same** final card!

Remember these card tricks every time you get the feeling that Someone must have stacked the deck before the universe was dealt. Each and every hand is just as improbable as any other.

These examples show that an unexpected result can come out of seemingly random and chaotic circumstances. Life's infinite complexity makes it bound to produce the unexpected coincidence, sometimes at random, sometimes for reasons we do not understand. Many of us have had some experience in life so unlikely as to seem supernatural or miraculous. If you haven't yet, just wait. When such an event occurs does it have to have a "reason" that science has yet to discover?

When an event occurs through *chance and necessity* or purely by accident, there is no "reason" hiding in any of the familiar places. It is useless to look for it there. Doing so is not a lot different from a drunk looking for his house key under a street light, simply because the **light** is so much better there than it is by his darkened door!

Fortune tellers also use the principle of chance and necessity. Starting from the probable, they first sniff out some handles on your life, then they go after patterns and connections. They are good at reading initial stereotypes and your reactions to what they are saying. Generally, they describe both your past and your future in terms vague enough to fit some circumstance you can recognize, and then they home in on the particulars. They may appear to be tapping into some greater area of Cause and Effect, but they are not. They do have a skill, no doubt, but not supernatural ability.

## The Ancient Covenant

Man's *ancient covenant* is an agreement. It binds man to himself and to that which he holds greater than himself. It stems from ancient needs: The need for authority, the need for purpose, and the need to believe in a final cause. Man has a need for order, hope, and his own place in the continuity of the universe. He identifies with, and is compelled by, a host of archetypal concepts. He tends to fear the complex, the not easily understood, and the naturally mysterious (such as radiation, low frequency EMFs, chemicals, and poisons).

The non-living universe is objective. The truth and knowledge of it can be gotten at without interpreting phenomena in terms of purposes or ultimate causes in any way. This is not true for living beings. The biosphere (and everything in it) is a unique occurrence that cannot be deduced from first principles.

The properties that may emerge from a sufficiently complex system always have this characteristic. The principles that are sufficient to describe such a system are never sufficient to describe the properties that may emerge from the system. The truth of this has been proven in the form of Gödel's Incompleteness Theorem.

There can never be a "Universal Theory." Properties emerge from a system as a single instance **allowed** by the system, not as an outcome **necessitated** by it.

Examination of our biosphere indicates that all living things had a common ancestor. Thus, all life on earth evolved from a single event that had an almost zero probability of occurrence. A unique occurrence is anathema to science, and yet it is fundamental to evolution. Among all the events and phenomena in the universe, the **a priori** probability of any particular one of them verges upon zero. Yet, the universe exists. Particular events, the probability of which is infinitesimal beforehand, must nevertheless happen.

*Epigenesis* is the revelation of an unexpressed design, but *evolution* is the emergence of the unforeseeable, the absolutely new. It is the author of **new** designs. *Destiny* is written concurrent with an event, not prior to it. An organism has a birth, and at birth a destiny; a species has no birth, therefore it can have no destiny, it simply has encounters with *fate*.

We must distinguish between the separate roles we play. First we are individuals with a life to live and a destiny of our own. We can discover much by looking within ourselves and at each other. Second, there is our extended heritage, our world of ideas. We are the environment for those ideas, we reproduce them and we collectively determine which shall survive. Third, we form and perpetuate institutions.

Both of these latter are separate species, evolving along with our own. They cannot help but have a great impact on our own evolution, just as our nature obviously affects them. For example, ideas having the highest invading potential, those most infectious, are those that **explain** us by assigning us a place in an immanent destiny. One in which our anxiety is allowed to dissolve. It could be argued that any idea with a high invading potential is an idea connected to our ancient covenant. If we understand the pattern formed by ideas that have the potential to **invade** us, then we have some concept of how our ancient covenant came to be.

## Mysticism and the Occult

People's need to understand the world about them cuts very deep. It cuts much deeper than true understanding. Our need is satisfied by any belief that tends to connect things to us, and to each other. It simply needs to state that there is a sense in things, and that we are included in the "big" pattern.

*Mysticism* refers to practices that are supposed to bring one into direct contact with the divine, or enable the direct perception of knowledge. These practices include meditation and contemplation and development of higher faculties under the guidance of a master.

The *occult* is anything that is hidden from the mainstream. It refers to a wider range of practices and knowledge than mysticism, the goal being access not only to knowledge, but forces, that are beyond the reach and understanding of ordinary people. The occult includes voodoo and astrology, alchemy and witchcraft.

Systems that offer to explain and prescribe medication, exercise, or treatment without the backing of scientific research and general scientific acceptance, are properly classified as occult. They may have much to do with human psychology, but, as pathways to the ultimate "truth," they are dead ends. These are radical practices and beliefs in opposition to the purposely conservative practices and beliefs of science. Sometimes they offer unique value, but in time that value gravitates to the main body of science. The harm done by systems and believers of the occult outweighs the good they do; the discoveries they make are fewer than the ones they impede; the understanding they provide is less than that which they exclude.

To complete the definition of *mysticism* its **subjective** orientation, as opposed to the **objective** orientation of science, needs to be emphasized. At various times mainstream psychology and philosophy have spawned branches that emphasized the subjective. Inevitably this has caused a split with mainstream science, not because they became mystical, but because the subjective is impossible to treat within the framework of the scientific method.

Schools and practices whose goal is mysticism usually wind up in the arena of the occult. Mysticism and science are not incompatible any more than a **scientist** is incompatible with science. A scientist does not succeed by denying his human condition, if anything, science is more successful when it embraces human values.

The proper pursuit of the mystical does occur. It is the pursuit of a skill. Like the pursuit of any other skill, the format for it is the *master-apprentice* relationship.

The contact between qualified apprentices and genuine masters is sufficient to keep this tradition alive, but little more. Many of the seekers for these schools are unqualified to learn; many of the schools are unqualified to teach what is sought, being little more than a response to an existing demand.

> The reason for counterfeiters is that there exist things of real value.

Everyone has some contact with the subjective. That side of one's nature cannot, and should not, be ignored. Everyone also has a need to learn and feel an understanding of the world around them. Most of us settle for what we can get, but usually with some hunger not quite satisfied. Perhaps we sense that these things relate to our ancient covenant. We have lost the contact with them that we need to be complete. This situation needs to be repaired.

## Archetypes and Folk Tales

An *archetype* is a concept so easily learned that almost no one can grow up without doing so. Related to archetypes are various common, but irrational, fears and affinities.

The fears of falling, heights, spiders, forgetting something at just the wrong moment, and many others are ancient and archetypal fears. A desire to fly is an archetypal need associated with angels and other things "on high." Wolves, tigers, bears, snakes, and spiders are ancient enemies and easily feared or hated. Perhaps our love of the domesticated versions of tigers and wolves is our way of making peace with these phobias. Our pursuit of the flying machine is older than recorded history.

Other ancient enemies are the fatal mistakes that we all fear to make. An unexpected fall is perhaps the most common. Having the responsibility for delivering a message and forgetting the message is another (failing to show up for the final, forgetting homework, other nightmares of the student). Another archetype is the fear of the dark and of the endless bogeymen capable of getting at us only in the dark. Many archetypes relate to death, such as ghosts and vampires.

In the past some of these archetypes may have had survival value to us. We have natural tendencies to embed them into our understanding of the world. The telling of folk tales is an ancient practice that permits the capture and propagation of archetypes in a very reliable and efficient format. As our ancient wisdom, primarily in the form of archetypes, began to grow, it was recorded and passed on as folk tales. Folk tales have evolved to transmit not only an expanding repertoire of archetypes, but epic events, odysseys, and ultimately even moral and religious structures.

Today, we have fables, teaching stories, myths, and tales. A formal genealogy of these may or may not exist, but it might be useful to propose an informal classification to show how stories are used to transmit different kinds of knowledge.

First, take *tales*. Let this designation include all the folk tales that transmit only outdated, useless, or incorrect knowledge. The sense of "tale" will be that in the phrase "telling a tale." Tales include urban myths, ghost stories, and many of our "old jokes" that have survived for generations. Tales are never going to go away. Some will die out, others will emerge, there will always be a supply and demand. Often, a tale slightly mutated can become more than a tale, just as one of the other story forms can mutate into nothing more than a tale.

Next, we have *myths*. The original purpose of myths was to record history, culture, tradition, and religion. Many myths have found their way into modern books, others stem from more primitive cultures and still exist only as a verbal tradition.

*Fables* are somewhere between myths and teaching stories. Instead of recording history, they focus more on moral and practical events, knowledge of a more timeless nature. *Teaching stories* have this goal as a specific intent. A teaching story is updated to make it suitable to its audience. A fable may have lost contact with its original audience. Myths, fables, and teaching stories may mutate into one another over time. Teaching stories are generally those most recently touched by a master of the esoteric.

## The Country of the Blind

Once there was a country in which all the citizens were blind. It had not always been so, in fact there were myths and legends wherein all men and women had been able to exercise a faculty called **sight**. Some of the language of that time still survived in words like "see" meaning to understand, "insight," and "a flash of understanding."

Then, for unknown and forgotten reasons, a change took place. All adults had lost the ability to see, even though there was nothing wrong with their eyes. What had happened was that their eyelids had become permanently closed and the muscles, for want of exercising, had all but withered away. The capacity to open their eyes had been lost; finally, nobody even knew that it could be done.

Only the adults of the populace became blind in this way. Their children were born with a normal ability to see, but since they were brought up in houses in which there were no windows, and very little light, they had little opportunity to **learn** to see. They noticed that their parents kept their eyelids permanently closed, and they soon learned to copy them. They, of course, became blind in turn.

A dim memory of this early vision remained with them, and for some this kept alive at least the idea of sight. Even so, most adults scoffed at the idea of sightedness, dismissing it as a childish fantasy. A vague and confused knowledge of the seeing ability of children persisted, nonetheless, and since these people could not credit that their young really could see, they dismissed the idea, or displaced it to the pre-natal condition, where its reality could not be checked.

This fiction was very conveniently used by the psychologists of the land when confronted with those in an "unbalanced" mental state, who, claiming that they could see, asserted that the community's blindness was running it into a condition of great danger. Their state was explained away as "an infantile desire to return to the womb," and dismissed as nonsense in that vein. More support for the

“back-to-the-womb” theory came when such people claimed, from time to time, that the faculty of sight would enable one to perceive one’s origins.

The land where these people eked out a living was situated in a remote corner of the planet. They named their country “The Earth,” and they called themselves “The People of the Earth.” One day a Stranger appeared in their midst. He was at first astonished, then saddened, and finally filled with a great compassion for the afflicted state of the inhabitants. They welcomed him kindly, and asked from whence he came. “From beyond the stars,” he said. Of course they did not know of stars from any immediate experience of their own, but the phrase had persisted in the vernacular with the meaning of “a long way off,” and it was in this sense that they understood him.

The Stranger decided to make it his task to restore vision to the people, even if it should take more than a generation to complete the assignment. Soon, his intelligence told him that he would have to approach the problem indirectly, if he were to make any useful headway. To simply announce his own capacity of sight would only provoke hostility, or incredulity, or attract the attentions of the gullible and those unbalanced ones who would in any case be unable to make constructive use of sight. So, the intelligent Stranger sank himself into their culture, obtaining meanwhile a menial job, both to support himself, and to learn first hand the more subtle aspects of their thinking and their habits of living.

The Stranger, pursuing clues to the persistence of the community’s ideas of vision, first explored the nature of the religious institutions of the land, seeking information as to their beliefs and their origin. Though their ideas and methods had proliferated greatly, and had developed in many different directions since their original formulation, he found that all ultimately derived from the science of Astronomy. References to the heavens and to the orbiting of the planets abounded in their sacred texts, though now in such disguised and covert forms as to be almost unrecognizable.

Their temples, he observed, were constructed in the form of an astronomical observatory. At one end was to be found a large dome with sliding panels opening to the skies, and in the holiest of enclosures was their most sacred relic: A large, fully functional astronomical telescope. It was complete with mirrors, lenses, eyepiece, and other optical accessories.

At least in the most ancient of their temples this was so. In the more modern buildings, progress had been rampant. The panels had been dispensed with, since they occasionally gave trouble with the weather letting in the wind and the rain. The telescope, too, had been modernized. Reduced to its bare “essentials” it now consisted entirely of a large and beautifully polished ornate plastic tube closed at both ends.

Continuing his search, the Stranger next sought evidence of sightedness in the operations of the various Ocular Societies that abounded. Most notable among these was the Society for Truth through Astronomical Revelation. Proud, particularly of their name with its highly significant acronym, its adherents had failed to notice that, when reversed, it terrifyingly described their truer nature: Curiosity-seeking scavengers, desperately culling tidbits of emotional excitement with which they sought to moisten the dry-as-dust nutrition of processed information that poured in on them from all sides in their semi-automated lives.

These latter-day alchemists had, in fact, kept alive scraps of knowledge of the now long-forgotten science of chemistry, time having selected those features which they had found of most use in their special observances. The knowledge of the techniques for the extraction of base metals from rocks had been retained and refined, and was now used to prepare and purify samples of magnesium. At special and secret ceremonies a small quantity of the metallic powder would be ignited, and the

brilliance of the resulting flash would penetrate, for a brief instant, even the thickness of their closed and sunken eyelids.

With the realization of the futility of associating with “derelict” organizations, no matter how large their following, how august their origin, or noble their original intentions, the Stranger perceived that the only effective way to demonstrate both the reality of sight and its constructive use for the well-being of the individual and society-at-large, was for the Stranger himself to become an example to a small group of followers.

One such would-be disciple enters our story now. He knew about sight, but far less than he thought he knew. As a child he had struggled against the invading darkness, terrified at the seeming madness of the actions of those around him. He was, in turn, called mad by them, and treated almost as an outcast. Growing up in solitude, knowing little of love or friendship, he struggled on alone, shielding himself behind a protective mask of aloofness, rebelliousness, and feelings of superiority. These features grew around him until they became an integral part of his personality.

When, eventually, he reached manhood, he achieved an uneasy contact with the world, importing his peculiar characteristics in a vain attempt to right the conditions of injustice of that time and place. But he was now blind like the rest, his attempts foundered, and he realized with sadness that a change must first come within the hearts of man. Plying his trade, he worked his way eventually to the top of his profession and achieved, at long last, the recognition he had craved. Feeding into his vanity, the richness of his surroundings seduced him, and he succumbed to its indulgence. Seeking pleasure, he lost any real consciousness of the world, and of his original intent.

His encounter with the Stranger aroused him to a fever of activity. With frenzied fingers he tore into the fabric of his face, seeking to bare his eyes by force. His failure drove him to yet further desperations until, all but overwhelmed by the inpourings from his self-inflicted wounds, he wrenched his hands away, and sank to rest, motionless and exhausted. At that instant, as if by a miracle, effortlessly and unsought, his eyes flickered open just for a moment. Gasping in astonishment he saw the rim of the morning sun rising over the distant mountains and bathing the valley in gold. But, insufficiently prepared, he was unable to sustain this flood, viscous trickle though it was, and his eyelids closed once more.

Conscious memory of the **content** of this event evaporated, and all that was left was the recollection that the event had occurred. Now he was becalmed, and in a sense satisfied. With quiet and sober resolution he turned towards the real problems ahead. They seemed vast, and he realized with a shock how ill-equipped he was for such a task.

Unsure of himself, and fighting against his own inertia, he watched the Stranger’s preparations from afar, helping when asked, as best he could. Unwittingly, he began to create within himself a false but enchanting feeling of serenity, and he almost became unconscious once again. But, at last he perceived that he had **mistaken** his experience as some form of **arrival**. Resolving yet again to follow the dictates of his conscience, he racked his brains for the means whereby he had once struggled to the top of his profession and had gained popular recognition.

The Stranger, meanwhile, had imported special instruments for the delicate optical operation that lay ahead. The disciple wished to see them, but was told that they could only be seen **after** the operation, when he had benefited from their precise and correct use. Given a concave magnifying mirror to feel he cried, “But this is only a dish, though finely polished and amazingly smooth.” And he began to wonder if he would ever be ready when his time came. With a tone as of impatience the Stranger asked, “Do you,

then, wish to live the rest of your life without the benefits of the faculty of sight?" After a brief instant of further indecision the disciple finally replied that, of course, he wished to go through with it.

About the operation itself, very little can be said at this time, but it seemed the most natural thing in the world. Opening his eyes behind protective dark glasses, the disciple saw that others, too, had had their sight restored. He found that they could recognize each other readily, and with complete certainty, even at a distance. The superstitions of that land had even hinted at this possibility, labeling it "clear-vision," though with no idea at all of what it might be like.

Looking with their newly-opened eyes, the disciples could now share the heavy burden of **seeing** the true and terrible nature of the community's present precarious condition. With the loss of sight, the knowledge of the nature of the community's true destiny had also been lost. Pleasurable indulgences of all sorts had taken over as the aim of life, and vast and powerful industries had been created to feed these tastes and to develop yet others. These latter were then widely advertised, not just to inform, but to motivate as well.

The pursuit of entertainment in this way was all but universal, though it often took disguised or bizarre forms, such as culling pleasure from the very act of charity itself, or even from the kudos of engaging in pointless and sometimes painful, but always trendy acts of sacrifice. Learning was no longer pursued for its own sake, but for its pleasure and entertainment value, or, at best, as part of the training for earning a living. Meanwhile, long-neglected and crucially important and urgent matters, concerned with the ultimate survival and destiny of the inhabitants, remained unnoticed and untended.

It was to this perilous state that the disciples now addressed their efforts. They soon found that most of the adults, even the highly intelligent ones, were too set in their ways to be able to readily learn to see. They realized that progress could best be made with those in a condition nearest to the natural human state.

Here and there, certain young children, as yet untainted with the seduction of the search for pleasure as an end in itself, were adjusting awkwardly to the distorting demands of their surroundings. Reared in an era of permissiveness, they still had not lost the taste for the fruits of disciplined efforts. It was to these youngsters that the disciples turned their attention, founding a school for special education.

At first the community was suspicious, not comprehending the nature of this enterprise. But well-meaning and loving mothers, unable to cope with their bright but willful offspring, and remembering vaguely the oppressiveness of their own upbringing, tentatively approached this new offering.

The children, for their part, when they saw that their mentors' eyes were, indeed, open and fully functioning, rushed to be received, and settled down rapidly to the delights of real study. So marked was their improvement that the word soon spread, and the disciples had difficulty in coping with the growing demand. They took on helpers, sightless ones, who, nonetheless, seemed closely akin to them in their thoughts and attitudes. Miraculously, almost, as they became infected with the atmosphere of the place, their eyes began to open, and they started to share, in their turn, the responsibilities of the sighted state.

When the helpers returned back into the community, the ideas spread with them, like a benign contagion, and gradually the inhabitants as a whole began to awaken, opening their eyes in both shock and great wonder. Soon, only the very old, and those afflicted with real blindness, remained untouched. And the community turned its efforts to rediscovering its basic purpose.

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Solutions to the significant problems facing modern society demand a widespread, **qualitative** improvement in thinking and understanding. We are becoming aware that contemporary challenges, such as the use of energy, the unchecked increases in population, the environment, employment, the health and psychological well-being of individuals, and the meaningful education of our youth are **not being met** by the mere accumulation of **more** data, or the expenditure of **more** time, energy, or money. We cannot sit back and hope that technology will cure our social ills. We need a breakthrough in **ourselves**, in the quality of thinking employed by decision-makers at all levels of society, and by each of us in our daily affairs.

## Moral Behavior

Let's get back to moral and ethical **behavior**. What is it? *Morals* are **principles and values** that **lead** to standards of behavior and conduct. *Ethics* are the **rules and standards** themselves. To the degree that behavior or conduct **affects another person**, it is subject to moral and ethical criteria. These truisms are derived by looking at civilized man interacting with himself. They are pretty much a part of our nature.

Morals and ethics are closely related to the concepts of right and wrong, good and evil. To some, moral behavior is "proper" **sexual** behavior, and ethical behavior is all **other** "proper" behavior.

Here, we will leave the definition of proper sexual behavior to the discretion of consenting adults in private, and treat all behavior, sexual or otherwise, the same. The focus then is on **behavior**, whether it's acceptable or unacceptable. Let's try to define the **principles** that distinguish acceptable from unacceptable behavior.

When people choose as they have been taught to choose, the concept of free choice is a deception.

People should make choices that will bring about an outcome that they desire on the basis of knowledge and understanding. If the correct choice has been learned by rote, it's not a case of doing right or wrong, it's a case of following or disobeying. Freedom is the **latitude** to take action based on intention and understanding. Freedom is an illusion if people are merely **allowed** to disobey.

If one has the **freedom** to choose, there must be a **latitude** of choice and no **programmed** basis on which to make it. There must be **some** basis, however. And, in many cases, there is a **moral** basis. It is the purpose of this section to sort this out.

The first obvious basis for making a choice is to do whatever is to your own best advantage. However, we live within a society and within an environment. We are not "closed systems." Both of these are a part of us, and our "own best advantage" has no meaning apart from them. When our conduct has an impact on the environment or on another person, morality comes into play. When the impact is small, or our own needs are great, moral considerations may be minimal.

A number of principles have been stated to guide acceptable conduct. One is the Golden Rule: "Do unto others as you would have them do unto you." This doesn't quite cover the behavior of a masochist, or anyone else who desires a non-standard treatment from others. But, it's more useful than a rule like, "Do unto others as they would have you do unto them," because it's hard to know what others want, and it's unacceptable to expect a dialog before every action.

Other versions of the Golden Rule are, "It's okay if it doesn't hurt anybody." And, "Anything is okay between two consenting adults." A different approach is taken by the rule: "Your freedom ends where the next person's freedom begins (and vice versa)."

These rules all assume that people's behavior affects other people. Some approaches to morality judge behavior in and of itself, without regard to the consequences. However, that is not the approach taken here. Both intentions and consequences count. When consequences are judged, intention has to be considered. The road to hell may be paved with **good** intentions, but malicious intentions are punished here and now.

Let's consider an action and its intended consequences. A generic action may have no intended effect on another. It may be intended for another's information, entertainment, or other (shock?) value. It may temporarily or permanently use something that another person also has a right to use. It may have a direct or indirect physical or mental consequence to another person, intended or otherwise.

Our free country was founded on the principle that an individual's expression should be freely allowed, as long as no transgression is involved. However, expression can span the gamut from quietly writing or saying something, to acts of physical creation, change, or destruction. Transgression can also take on many forms. It may be in the form of an offense to someone or their beliefs, or an infringement on their rights, their property, or their person.

An expression generally has a positive value to its maker, just as an offense has a negative value to its object. When offended, one may ignore or evade the source of the offense, or return an offense of similar magnitude. The result of trading offenses is usually an escalation that leads to fight or flight. This is not a civilized outcome. In a free and civilized society, if the positive value of an expression is greater than the negative value of its offense, it **may** be allowable. If the only intent of an expression **is** offense, or if the negative outweighs the positive, then the expression may be unethical and might properly be censured.

An expression may be **intended** to have a positive effect, but actually get a mixed review. If more people are offended by something than are not offended, it may be that an expression or a genre of expressions should be regulated. In the large, modern society has developed some fairly civilized procedures for handling these situations, but many times certain individuals fall short in the execution.

Most expressions are intended positively and give little offense. These are basically ethical, everyday expressions that form the bulk of our behavior and communication with each other.

Many actions that affect others are not expressive behavior, but behavior that is primarily useful to ourselves. People are **used** if they are directly affected by, and don't benefit from, an action. Otherwise, people are either directly, indirectly, or not, affected by an action. Other actions affect **things** (the environment, for example) directly, and people indirectly. Things may be temporarily used and left unchanged, they may be permanently used up, changed, or degraded, or they may be possessed.

Most of human behavior is subject to the principles of ethics; the law takes over in extraordinary cases of transgression. Ethics involves behavior in the following areas: Ownership, the use of the commons, and the use of power. The use of the commons includes the use of a right-of-way, the environment, and natural resources.

> Do not what the law allows, but what reason, justice, and humanity advise.

The most ethical behavior benefits everyone affected, and harms no one. Some behavior benefits some at the expense of others. The more the benefit relative to the expense, and the less the expense is borne by a small minority, the more ethical the behavior **may** be. Laws and regulations spell out fairly

clearly the rights and duties involved in ownership, the treatment of the environment, and the uses of natural resources. Ethical behavior in these areas is largely following the law.

This leaves somewhat more open to question the use of rights-of-way, the use of power, and the use and overlap of personal environments.

For example, when I drive my car through a two-way intersection, the intersection is a commodity which I must have sole use of for the length of time it takes me to get through it. The general case of right-of-way involves several people who all wish to use some commodity. Right-of-way is an attempt to resolve the ambiguities inherent in situations of this sort. When there is ambiguity in a right-of-way assignment, or difficulty in communication of the assignment, it is often yielded by all of the users until the ambiguity can be resolved either by adventure or by determination.

The rules for assigning right-of-way are fairly appropriate to the simple, interpersonal allocation of the commons, such as personal space and immediate access to air and water.

Behavior or conduct consists of acts performed by an individual in private, before an audience, or in direct interaction with others. A private act is not one that simply has a delayed effect on others, it is one that has no significant effect at all. An audience may be a willing or unwilling witness to an action. Also, the presence of an audience may be known or unknown to the subject of an action. All of these are factors that relate to the morality of behavior.

> If the fault were all on one side, disputes would be quickly ended.

Ethics involving *power* divide into two parts. There are different rules for the person of power, and for those under the influence of power. We are all in the second category, and from time to time some of us may visit the first category.

The ethical person of power simply tries to give more than he gets. He tries to make his interactions and exchanges a positive sum for all participants, taking his profits from the value he creates by controlling the interaction, and not by causing a loss to others.

The ethical person playing a part in someone else's circle of power, commits to his role, but remains aware and lets others know where he stands if his commitment is questioned (especially by himself). It is ethical to be a source of feedback, but it is not ethical to work at cross purposes or to withhold one's commitment in secret.

## Politics and Government

Some people have strong religious beliefs, others have strong political beliefs. Some have both, and draw no line between them. It is pretty clear, from the ideas and logic presented here, that strong beliefs in orthodox religion and politics are not being advocated. Instead, belief should be provisional and conditional, and strong **opinions** should simply be eschewed. Not everyone wants to live this way. In fact, most people **will** not. However, this book is for those who can allow themselves to entertain the idea.

A rational approach to religion may produce an agnostic, but there is no similar approach towards politics. Many of the fences that divide people in politics are picket fences, it is difficult, even painful, not to be on one side or the other.

When religion and politics are combined, the force of conscience and the means of malice are joined. Wisdom may be found in both science and religion, perhaps even in politics. Malice may be absent in

both religion and politics, and yet it is often generated by their combination. Thus, keep religion and politics apart, and encourage science in both.

> Wisdom and malice cannot live together; science and conscience should never live apart.

People whose minds are shaped by beliefs and opinion, rather than knowledge and understanding, may disagree. There will always be those best served by combining politics and religion.

The rest of us simply have to deal with this. No country in history was founded with better tools to address this threat than the United States of America. The most important thing for us is to keep it this way. We must remember:

> Vigilance is the price of freedom.

In fact, many of the improvements our government needs would move us even farther in this direction. That is, in the direction of better separation of church and state (the separation of beliefs and regulations), and to minimize even more the effects of special interests and opinions on the rights and freedom of individuals.

## Needs and Society

Society enables the existence and conferment of *power* to certain individuals and groups for the purpose of controlling individuals. Each of us has a need for the security of the group, a security that is threatened more often by renegade humans than by other forces or animals. We have evolved as a social animal, so we have tendencies to recognize and comply with the power structures of groups.

Our needs and tendencies as individuals have evolved to fit together with those of society. Power is **sought** by some, but always gained **from** those who possess it, ultimately from a willing or acquiescent group. It is society's nature to have power over the individual. It is an individual's nature to seek a place within the power structures of their groups. Power structures evolve, sometimes through violent death and birth cycles. Modern power structures are connected to institutions: Businesses, corporations, governments, and their separate agencies, clubs, churches, and other groups or gangs in a community or neighborhood.

Government is at the top of this hierarchy. Business and other institutions are its partners. Government usually exists as a **collection** of institutions. Every other entity in society is an institution, too: Formal as in the case of profit and non-profit corporations, and informal as in the case of clubs and gangs.

## Crime and Joblessness

What are the institutions that we have to target if our "social engineering" goal is to reduce crime and joblessness in inner cities and places like South Central Los Angeles? We must target the ones with the greatest connection to the people most highly involved in crime, and secondarily, in joblessness. It is a mistake to assume that crime will be cured when the criminals can find jobs. It is a mistake to assume that places where it is easy to spend money are also places where a cure is to be found. Would better housing, better schools and teachers, and a ready source of new jobs be the **cause** of the cure, or the **effect**?

> During the 1960s, one neighborhood in San Francisco had the lowest income, the highest unemployment rate, the highest proportion of families with incomes under $4,000 a year, the least educational attainment, the highest tuberculosis rate, and the highest proportion of substandard

> housing. . . . That neighborhood was called Chinatown. Yet in 1965, there were only five persons of Chinese ancestry committed to prison in the entire state of California.
>
> - Wilson and Herrnstein
> *Crime and Human Nature*

A careful look at crime statistics and unemployment rates, and especially at the demographics of the people in the areas in question, are revealing. Of course, if they prove that money is being spent incorrectly, or don't give an easy answer as to how to spend money, it may be easier and better for one's political future to avoid any of the revelations that might follow.

One might counter to the quote above that the Chinese at that time were very effective at concealing the crime within their inner city, and that there was little traffic with the outside. This may have been true to some extent, but even so it demonstrates the presence and working effectiveness of a tightly knit social structure. It is a structure such as that, that the community itself has to work with to make social change.

Getting back to demographics, twice the number of boys between the ages of 14 and 16 are convicted of crimes than men between 25 and 30 in South Central Los Angeles. If joblessness were the motivation to commit crimes, you would think that a man approaching 30 would be more motivated by it than a teenager, and that a married man out of work would be more desperate than a single man. For that matter, a single woman with children should be the most motivated of all. And yet, it is the reverse. Women are far less disposed toward crime, especially violent crime, than men. Married men are less involved with it than single men, and older men less than younger men or teenagers.

In New York City, the homicide rate tripled between 1963 and 1973, and most other types of crime followed suit. In 1961, unemployment was at 6.6% and by 1969 it had dropped to 3.4%. The incidence of robbery had tripled in this same time period. Again, who knows how good the collection of statistics was, or whether it was equivalent at both ends of this period, but

> ...these patterns are well known to criminologists.
>
> - David Rubinstein
> University of Illinois

> Unemployment may affect the crime rate, but even if it does, its general effect is too slight to be measured.
>
> - Thomas Orsagh
> Criminologist

Estimates by experts in some of these urban areas have stated that even if unemployment were cut in half, the crime rate would drop no more than 5%. On the contrary, there is even evidence to suggest that crime, like any other business activity, **turns up** in better economic times.

Instead of spending money on health care, why not directly confront the destructive life styles that are the real cause of poor health? Instead of spending more money on schools, why not attack the lack of motivation to learn? Instead of pouring money into the inner city to create jobs, why not find ways to motivate the people there to help themselves by mending their social fabric and strengthening the institutions they already have in place, including the teenage gangs? These aren't easy approaches. But, these aren't easy problems. We may not be prepared to make a frontal attack along these lines like we are when the alternative is well known ways of spending money. But again, let's search for the key where we lost it, not where it might be easiest to find.

## Helplessness

Consider the elderly and the people of the third world, including the bits of the third world attached to most large cities. Those in the third world know how the rich nations of the western world live, and they have to believe they are on the road to the good life, too. But, it's farther away than they think.

The life style of many of the elderly in the western world is slipping away too. They are being squeezed between the cost of living and their social security payments. Many of them were victims of their own gullibility. They believed the voice and pictures of advertising. The good life was theirs for the taking. They had earned it, hadn't they?

So, they spent what they earned and borrowed as much as they could. They bought boats and trailers, water skis, snow skis, summer cabins or motor homes, trail bikes, mountain bikes, binoculars, stereos, watches, radios, and TVs for every member of the family. When anything broke, it was time to replace it; no sense in repairing something that was obsolete.

Many started with some form of savings plan, but when social security started to pay more and the dollar began to shrink, a lot of people decided, "Why save when you can borrow?" Why worry when the government is looking out for you anyway?

Now the anger of the elderly and the poor is aimed at society. It's not in people's nature to look back at their own vulnerability. No one sees the thousands of dollars blown on merchandise, interest, and carrying charges that could have gone into savings. They know things are badly out of hand, but they don't blame themselves. They just did what everybody else was doing.

## Crime in Government

Except for the criminal who uses it to make a living, we would all probably agree that extortion is a bad thing. But, first let's look at how the dictionary defines it, and then let's see where we find extortion evolving in today's world. *Extortion* is the use of force, ingenuity, coercion, intimidation, or power, to obtain from another person wealth or assistance to which one is not entitled, or which is excessive or exorbitant. Extortion is also the offense committed when an official position is used to obtain property or cooperation to which it is not entitled.

Society's increasing disposition to protect us from ourselves is eroding our freedom and imposing new costs. However, it hasn't stopped there. Society is fast developing new ways to protect itself from **individuals**, and this development is outpacing the safeguards that protect an individual **from society**. These new "protections" are often nothing more than sanctioned or legalized extortion. There's a pattern to how this evolves, but first let's take a look at a couple of examples.

Congress passed the "asset forfeiture law" as a weapon against drug dealers. It allows the "fruits" of illegal activities to be seized before their owners are even convicted of a crime. Assets can also be seized as evidence on the basis of a warrant, before charges are filed, prosecuted, and tried.

In one case, a computer game company was put out of business because all of its computer files were seized. It was thought that the files contained evidence having something to do with supposedly confidential information that was stolen from the telephone company. Later, it was called into question how confidential the information actually was. There was never a trial and it was never demonstrated

that illegal information was present in the computer files that were taken (it was clearly unknown at the time of the seizure).

Another case involved Operation Pipe, a series of government raids intended (in the words of the agent leading them) as a "frontal assault on the drug paraphernalia industry." Typical of what happened was that houses, bank accounts, stocks and bonds of owners or stockholders in these small businesses were seized and plea bargains were obtained. In one case, in exchange for a corporate guilty plea, a fine of $5000, and forfeiture of $45,458 to the U.S. Customs Asset Forfeiture Fund, the government released liens on two of the stockholder's homes, their bank accounts, and other personal property. In another case, the forfeiture was $2200, the fine $2000, and the government returned $8500 in seized cash and released a lien on the home of the owner's son. Were these the results of fair trials or extortion?

## Waste in Government

The average person spends about one-third of his earnings on federal taxes. He spends almost twice as much on federal taxes as on food and health care. Federal spending eats up about one-quarter of the nation's wealth. And yet, relatively few people directly benefit to this extent. As Tax Freedom Day (the day on which you have earned enough money to pay your year's taxes) has crept well into May of the calendar year, tax payers have become increasingly aware that they are getting a raw deal from their government.

There is wide spread belief and agreement that the government wastes about half of every dollar it spends. How has this situation come to be? How can it be reversed? The fundamental problem is that the government is too responsive to special interests. The public at large, having come to feel disenfranchised with the whole process of government and the choices given them in elections, has become more and more distanced from government. At the same time, special interest groups have gotten more closely involved in the process. Government has become a short term reaction increasingly focused on oiling the squeaky wheels.

Almost half of federal spending goes to the elderly, the poor, farmers, and veterans. These people make up about one-third of the population and much less in terms of their contribution to taxes (counting both past and present). Take the elderly, for instance. In 1990 the average amount spent per elderly person was $11,350. Two and a half million of the elderly are below the poverty level. And, the poverty level is drawn at about $6000. This doesn't add up until you know that most of the spending for Social Security and Medicare goes to the elderly rich and middle class. In fact, if all the money were divided equally among them, each of the elderly, the poor, farmers, and veterans would get a $9000 check.

In 1990, the federal government spent $150 billion to lift about 10% of our poor above the poverty line. State and local efforts raise this to a spending level of $210 billion, raising about 30 million of our 50 million poor above the poverty level. Real spending has increased 273% since 1968, yet the poor are now an even larger fraction of the population. One study showed that only 37 cents of every dollar spent was actually received by the poor. Some analysts believe this is because so much of the benefits are delivered to the poor in the form of services. No matter how you compute it, the total budget supplies more than enough money to put every low-income person above the poverty level.

Take away the waste, inefficiency, special interest pork barrels, and the one-half of the budget spent on the one-third of the population mentioned above, and very few dollars remain to benefit the other two-thirds of the population (who pay even more than two-thirds of the taxes).

Symptomatic of this is the way government spending trickles down. Even though Washington D.C. or any state's capital, should be spending money on behalf of the entire country or state, the per capita income in Washington D.C. is 42% above the average for the rest of the country, and in most state capitals it is 10% above the norm.

The problems are fairly clear and widely discussed. There are no easy answers, at least not here. There are only people. Some who will work to change things, because they can think and act clearly, others who will accept the way things are and allow them to become worse and worse until the lid blows off.

## Overprotection

It's part of our duty to protect our children, family, and friends, and it's natural to expect protection in return. "Protectionism" is **society's** tendency to provide ever increasing protection to its members, and impose upon them the costs associated with it. This may begin from a sense of duty, but it can go far beyond it.

A lot of things are only looked at from a "standard" point of view. It may be amusing to take the opposite point of view. For example,

> A chicken is an **egg's** way of making another **egg**.

Think of society as a whole. Why is it any funnier to think of an egg's point of view about a chicken than it is to think of a person's point of view about society? And yet, we all believe that society exists to protect, promote, and enrich **our** lives — not the other way around.

In reality it's neither one way **or** the other, it's **both** ways at once. We are components of our society and society is our natural environment. Our nature and destiny are very much connected to the society around us. Society is evolving much faster than we are, but our evolution is controlled by our long term reproductive success, and society influences that in many ways.

Perhaps from its need to guard its females and young during periods of vulnerability, human kind developed compassion. This advanced emotion is working as it should be when it protects the vulnerable and unfortunate from hostile forces, while expecting the less vulnerable to cope with these forces on their own.

But, when compassion translates into socially organized, universal protectionism it goes counter to other important needs. This whole topic concerns how we treat others and how others (society) should be allowed to treat, influence, and control us. What are some of the forms of protectionism that have been instituted in the past five or ten decades? What have we given up in exchange?

To get protection, you have to give up freedom and you often have to pay its economic costs as well. You could probably list hundreds of things this applies to, all the way from condoms to tariffs.

There's a difference between protection, especially when motivated by compassion or common sense, and protectionism imposed by society, institutions, and special interest groups. Society may start out with compassion, but both it and common sense often fall out of the equation. And then we are left with **less freedom** and costs that may be too high for the benefits.

Here is a short list of some of the things that could be examined in terms of costs and benefits; most of them do or did come up short, even if their original intentions were good.

Social security
Trade unions
The 55 mile an hour speed limit
OSHA
The EPA
The War on Drugs
Current copyright & patent laws

Why don't government workers and politicians pay social security? Why don't trade unions off-load their special interest power to the judicial system and simply cease to be? How many lifetimes worth of time did the driving public donate in extra time on the road for each life that was saved because of the 55 mph speed limit? What was the cost in driving time to save each gallon of gasoline? As for OSHA and the EPA, we'll get to them in the next chapter.

The war on drugs is a negative sum game; everybody loses. Why not make drugs legal like alcohol was when the "prohibition experiment" was terminated? The problems with alcohol didn't go away, but now alcohol is taxed and controlled, and those dealing in it aren't criminals. We could then confront drug problems more directly, and the underworld would find fewer drug-related opportunities.

We need some **real** creativity to solve the laws dealing with ownership of information. How do you draw the line through a gray area and grant less than 20 years protection on one side (for patents) and many times that amount (for copyrights) on the other? Too many patents are being accepted, and a few rejected, for reasons that can best be described as frivolous.

Some protections are "forced" on us, others are things like air bags and bicycle helmets that are "fashionable" to sign up for. The only case against air bags and helmets is one of consistency. How much do they cost to buy and use? What is the probability that they will benefit us? That's the first equation. The second equation comes from the following question: "Is there anything else I can do more cheaply or easily that will benefit me more?" How many people buy an airbag for their car and then make use of its cigarette lighter and ashtray? If you do a dozen things that are unhealthy or unsafe, then always wear a helmet when you occasionally ride your bike, the decision to buy the helmet was somewhat misdirected.

A protectionist attitude leads to the logic that if everyone spends a little, a few lives can be saved. More selfishly, if each of us spends a little, we can improve the odds on our own life. Less than one person in three thousand dies in an accident (that includes lightening, ladders, cars, and everything). How much do we need to spend in time or dollars, and how much can we change those odds? More to the point, shouldn't this be a decision that each of us has the right to make for ourselves? The argument that your tax dollars are going to pay for other's mistakes, doesn't stand up. First of all, little is being paid in comparison to many other sinkholes for public spending. Second, it is not written that society must pay for the folly of its citizens. If this is a burden you dislike, attack it at its roots; don't try to correct it by pruning at its leaves.

## Arrogation

*Arrogation* is the usurping of something that isn't yours. In this case, it refers to the tendency of government to get involved in areas inappropriate to government, such as religion, family values, and

generally any area within which individual freedom of expression and choice should prevail in a free country.

Freedom of speech means that the voice of reason and the mistaken opinion may always do battle.

A free country is one in which each minority, even the individual crackpot, has an equal right to their beliefs and practices so long as they do not encroach on the freedom of others.

Government trespasses by arrogation upon some of its citizens usually because other citizens compel it to. It is the syndrome of the censor and the pornographer. The actions of some are deemed **awful** by others, so government is entreated to make them officially unl**awful**.

Arrogation may occur by censorship, protectionism, or regulation. What is the pattern? One group of people starts doing something and another group of people rises up to oppose it. Some things become trendy to do, and other things become trendy to denounce. The real problem comes when the government gets involved on either side of one of these issues. In most cases, the government should act as no more than a referee. Occasionally, the government might be called upon to act as an advocate, censor, or regulator, but only in cases where an issue is supported by scientific or moral bedrock.

There are numerous issues in which we find government embroiled on one side or the other, where it should be acting as a referee. The war on drugs comes to mind. Abortion and pornography have already been mentioned. Others are global warming, occupational safety, and a whole slew of environmental issues. There are regulatory agencies to mandate equal access, equal opportunity, and policies pertaining to endangered species, wetlands, and air and water quality. Another issue, population control, looms just over the horizon. Has social security been a better answer for people than corporate pensions or individual retirement accounts? Why aren't government employees, themselves, required to participate in social security?

## Examples of Waste and Arrogation

Putting government in charge of protecting the environment seems like the best, perhaps the only, way to see that the job gets done. Taking charge of the commons, that's what government is for. But, for some reason, time after time, various government agencies have mixed bad science with politics and pressure groups, and have come up with burdensome regulations and billions of dollars of costs for a misguided tradeoff that produces no real gain for anybody: the taxpayer, the consumer, or the average citizen.

The following are some examples that illustrate this. The point is **not** that we should clean up any particular agency, or rectify only the problems cited here. The point is that we need to "fix" enough **people** so that these things happen only rarely. We need different procedures for carrying out the objectives of government.

For most of us, the following examples involve some controversy. All have been emotional issues in recent times. The general public has been led to accept each one as it happened. Here is another side to these stories. It may not be any more accurate or complete than the story you already know. But, what should be hard for **anyone** to believe is the amount of effort and money that have been spent on **change** when so much doubt exists over the facts.

# Reformulated Fuels

The problem: How to reduce air pollution, in particular that which comes from volatile organic compounds that are mostly emitted by cars. They can be reduced by controlling the fuel cars burn. As long as fuel is to be reformulated anyway, why not decree that it contain 2% oxygen as well? That way carbon monoxide levels can also be reduced. So far, EPA bureaucrats have written at least a hundred pages of "interpretation" and the reformulated gasoline **rules** have already cost the taxpayer millions of dollars just to **write**.

All of this stems from pressure groups and the incorrect assumption that gasoline as currently formulated and sold is an "unclean fuel;" that all cars will benefit from the reformulated gasoline. The fact is that only 10% of the cars on the road cause over half of the air pollution. By fixing or getting rid of these cars, air pollution could be cut in half. By reformulating fuel, we can only make a small dent in the other half of the source of pollution.

One major source of air pollution has to do with the volatility of gasoline. Current rules set volatility standards. The reformulated fuel, to meet its 2% oxygen requirement, would require that ethanol be added. For every gallon of ethanol currently used in gasoline, ethanol producers receive a 54 cent subsidy from the Federal Highway Trust Fund. Of course that's money not spent on highway repair and road construction. Part of that money goes to political action groups that spend money on politicians and the public leading them to this fuel reformulation program in the first place.

It's also true that plenty of chemists, accountants, and lawyers will be rewarded for their work in the five new layers of "gasoline police" that the government wants to create. But what about the rest of us who are footing the bill? Why isn't this just what we need? Isn't that government's job: To decide what we need, then give it to us? Well, not exactly. And, in this case, here's why.

According to the EPA's own data, new model cars in good condition are not producing that much pollution, and will not run significantly cleaner on a reformulated fuel. The EPA studied one group of 84 cars and found that the pollution output for the entire group could be improved 16% by performing an inexpensive repair on a single one of the cars. By comparison, the reformulated fuel program is expected to produce an overall improvement of only 15%. As for the 2% oxygen requirement, to be met by the addition of ethanol, this would increase the **volatility** of the fuel and thereby cut the pollution improvement to only 9%.

Why add ethanol to gasoline, anyway? The two answers are that the extra oxygen reduces carbon monoxide emissions, and it also reduces the consumption of fossil fuel. Lower carbon monoxide is important to some cities, like Denver in the winter, but ethanol increases emissions of nitrogen oxides, which under the summer sun combine with hydrocarbons to produce ozone. Ozone is the pollutant the EPA wanted to reduce in the first place. The final nail in the coffin of ethanol should be the fact it doesn't much reduce the burning of fossil fuel. As now produced, each gallon of ethanol requires diesel tractors and other equipment to produce the corn. It requires coal burning power plants to distill it. And, in many places, corn is irrigated using irreplaceable groundwater.

Complex plans like this have too many objectives, are almost impossible to evaluate, and are bound to have many unforeseen side-effects. They cost a great deal, and are seldom of equivalent benefit. They arise as a bandwagon that a lot of people can profit by jumping on. The opposition is made out to be spoilsports. In the end, such "cures" are often worse than the disease.

## The Ban on DDT

DDT was banned by the EPA in the 1970s. This ban was followed by many other countries. Perhaps, in the U.S., DDT had already done what it could, and its good had begun to be outweighed by its bad. It was used by all Allied troops in World War II with the result that no soldier was stricken by typhus fever for the first time in the history of warfare. By contrast, more soldiers died of typhus in World War I than died from bullets.

Mosquito-born malaria was the worst disease faced by man. To take an area from which there is data over the entire cycle, one which shows the picture for much of the rest of the tropical world, take what has happened in Sri Lanka during the past half century. In 1948, before DDT was used, there were 2.8 million cases of malaria. With the use of DDT, in 1963 there were only 17 cases. This extremely low level continued through the mid-1960s. Then the Sri Lankan officials, convinced by environmentalist attacks in the U.S. against DDT, suspended spraying. The number of malaria cases in Sri Lanka was back up to one million in 1968. In 1969 it was up to 2.5 million, about where it was before DDT was used in the first place.

The use of pesticides involves some tradeoffs. Here, one of the tradeoffs is clearly how many cases of malaria we are willing to tolerate (about 1% of people stricken with malaria die from it), so in Sri Lanka, because the pesticide is banned, presumably 28,000 people a year are dying from malaria.

What are we getting by paying this price? Longer, healthier lives for ourselves? No. For animals? Obviously for the targeted pests, yes. The use of pesticides allows us to raise U.S. food crops on some 10 million fewer square miles of crop land than without them. This means 10 million more square miles of wildlife habitat.

In early 1972, the EPA reported at a hearing that DDT “is not a carcinogenic hazard to man. The uses of DDT under [specific registrations] do not have a deleterious effect on freshwater fish, estuarine organisms, wild birds or other wildlife.” Six months after the hearing, the EPA banned DDT for all use except extreme emergencies. A few years later tussock moths defoliated nearly 700,000 acres of forest land in Washington, Oregon, and Northern Idaho. DDT was the only pesticide proven effective against them.

## Radon

Radon is an inert, radioactive gas that surfaces over uranium deposits. By itself, it is not particularly dangerous, but it often brings with it radioactive particulates that can be inhaled and lodged in the lungs. This could cause lung cancer. How is the government involved? First, it provided incentives and building codes that had the laudable objective of sealing up living spaces and offices to make them more energy efficient. Then it noticed that with fewer air changes, certain pollutants, including radon gas, tended to gather at more concentrated levels than before. Accordingly, the EPA has set a “danger” level of 4 picocuries per liter of air. More than this, and they felt that a risk of lung cancer could be incurred. This level is actually less than the amount of radiation in a normal amount of drinking water.

Other studies have shown that moderate levels of radiation may actually enhance one’s health (in other words, the data are not conclusive at this time). A 1987 study showed that areas with high radon levels had relatively low lung cancer rates. In 1989, the EPA Administrator declared Iowa to be the highest radon state in the country (seven times the national average). Its lung cancer death rate is 13% below

the national average. The model used by the EPA as the basis for their standard predicts 1600 cancer deaths from radon alone in Iowa. And yet there were only 1420 deaths related to any type of cancer in Iowa during that period. Something doesn't add up.

## Asbestos

Asbestos is a term that describes a variety of mineral fibers used commercially for insulation. They resist heat, electricity, and most chemical reactions. Their fibers can become airborne during mining, processing, and installation or removal. Exposure at occupational levels has been linked with various lung ailments, but almost always among workers who also smoke. The Asbestos Hazard Emergency Response Act, passed by Congress, became effective in late 1987. It mandated that school buildings be inspected for asbestos and protective action be taken where it was found.

In 1988 and 1989 the complete non-existence of scientific data to justify this action was brought to light. Several studies showed that no significant danger was posed by the presence of asbestos, but that some possibility of danger existed if the asbestos was disturbed, by removing it for instance. In 1990, the EPA admitted that the best way to handle asbestos in buildings might be not to handle it at all. This, after raising the issue to a panic level among many people, provoking after the fact much more study than would have been necessary if it had been done before passing the Act, not to mention the billions of dollars in unnecessary, and perhaps risky, removal of asbestos.

## PCBs

PCBs are over 200 different polychlorinated biphenyls, chemicals that are non-flammable and stable over a wide range of temperatures and physical conditions. They are ideal lubricants and coolants in different types of electrical equipment. After their introduction in 1929, they were required by many city codes because of their success in reducing fire hazards in electrical transformers.

During the years of their use, PCB waste was routinely dumped into waterways where it was ingested by fish. From there it found its way elsewhere into the food chain. This caused an environmental scare. Here were indestructible chemicals building up in the biosphere with who knows what harmful effects. So, PCBs were banned by the EPA, forcing utility companies to revert to flammable mineral oil and other inferior substitutes for insulation in their transformer stations.

On July 29, 1990, a 14-square-mile section of Chicago's west side was blacked out after a fire in a transformer damaged a generating plant. Rioting broke out. It was Chicago in the summer time. Three members of one family died when the candle they were using touched off a fire. Clearly one hazard (perceived) has been traded for another hazard (real). Was the evidence sufficient to prove the benefit of the tradeoff?

No adverse health effects have ever been proved against PCBs as a result of their presence in the environment. It has been shown that PCBs do not remain stable in the environment, there are several strains of bacteria that degrade PCBs to other harmless substances. These bacteria have even been used to clean up PCB spills.

A comprehensive study of long-term exposure to PCBs involving some 2,500 workers, more than one-half of which were exposed on the job for over 20 years, reported no statistically significant excesses of cancer among them.

* * * * *

The theme of these stories is **not** to prove that government regulation is bad. The government **should** keep an eye on things. But it does hurt to overreact or react wrongly. Both license and regulation should be done conservatively. The facts should be gathered by impartial scientists, not by special interest groups. Expected benefits should be weighed against possible side effects and risks. When change seems indicated, it should be tested and proven for a limited time and place. We should demand more than emotional pressure from groups who seek to affect others, either through license or regulation.

These examples are not to "bash" environmentalists either, but to point out that premature and hysterical reaction to the presence of chemicals, radiation, and electromagnetic forces in our environment is not the way to drive a government. Government must mediate between the rational forces of science and the hysteria of crowd pressure that is inevitable from time to time. This is the same type of mediation we need from government to resolve disputes between capital and labor, and between believers and agnostics. Government should not take sides in these matters. Its job is to keep the ship of state on course and prevent reactionary jerking of the wheel.

Change should be initiated with care and restraint, not because we should fear change, but because change always brings with it the chance of a harmful or unintended consequence. Think carefully before calling for change, and draw conclusions with the discipline of a skeptic. This advice pertains not only to those who have the power to grant licenses and regulate behavior, but also to those who seek change in the regulations and licenses themselves. A wrongful and whiplashing change that affects **society** can be a "cure" that's worse than some environmental or special interest "disease."

A very important duty of government is summed up clearly by two of Robert's Rules of Order:

1. No **minority** has the right to **block** a majority from conducting the legal business of the organization.
2. No **majority** has the right to block a minority from peacefully attempting to **become** a majority.

In particular, government should never be asked or allowed to solve the problems of the handicapped by putting shackles on the gifted. It should not try to balance rich and poor by playing Robin Hood. And, when it passes laws based on the premise that "people have no right to do wrong," the government should be certain that the wrong involved is beyond dispute.

## Making a Difference

Here are two ways to make a difference. First, formulate a plan and work with others to make it a reality. Second, join the institution most concerned with the thing you want to change, and bring about the change from within. These are **constructive** ways to effect change.

Of course, there are **destructive** ways to make a difference, these may be the quickest and easiest ways at the disposal of individuals and the mobs they can incite. People will always display their need for attention. Boycotts and demonstrations are among the **least** destructive acts of a mob. In our imperfect world, they are often the only practical way to attract the media. This, in turn, brings a message to the masses. It is often a mixed message, however. It may stir up just as much opposition as support. The support may be more visible, but the opposition is often more damaging and insidious.

The process of change was discussed under the heading of **creation**. There it was argued that change can be brought about by design, building, and growth according to a plan, or it can evolve.

## Directed Evolution

The Lamarckian idea that acquired characteristics, or some kind of striving toward a final cause, can be passed on to one's offspring has been rejected by modern science. Change occurs at random in the copying process, but the selection process is far from random. Our behavior, who we choose for a mate and how many children we have, is a major factor. Many of our desires and ideals are reflected in our choice of a mate.

Science tells us that giraffes didn't develop long necks through a striving over many generations to reach the better leaves at the top of the tree, but it's possible that long necks were somehow prized by giraffes in some dim awareness that a longer neck was a way to get at those tasty top leaves. Is it inconceivable that this could have translated to a preference for a mate with a long neck? Elements of behavior operating as part of the selection mechanism could easily explain rapid evolution in what seems to be a purposeful direction. In this way, a connection is made between anatomical adaptations and specific performances.

Why couldn't the prizing of intelligence have been the primary factor in its amplification and development? Again, it would be through an initially dim awareness of it in choosing a mate.

Studies of intelligence always seem to show less correlation than expected between measured intelligence and any measures of success in life, but there is considerable correlation between different measures of intelligence and unskilled estimates of intelligence. Whatever it is, it's there, even though it's not clear what it's good for. If it's not good for much, then how did it evolve? All intelligence has to be is a recognizable and valued attribute in a mate. This one condition is sufficient for the rapid evolution of intelligence.

There is no doubt that we are able to alter the forces of "natural selection" upon ourselves. Poor eyesight, for example, is not the drawback it once was. Intelligence is still prized, but even more, success and power are prized. Today, these are gained by successfully interacting with ideas and institutions.

## Institutions and Change

Constructive social change will be brought about through the actions of institutions. Individuals will play the parts they are able, but most usefully within the structure of an institution. New structure may be designed. Institutions may be created or destroyed.

We can't engineer evolution, but we can engineer plans for growth. If the basic social structure is the institution, we can design and modify the plans from which we construct them. This would be social engineering. It is important that we abandon the quick-fix mode of regulating institutions, and actually begin to consciously, and with purpose, affect their design.

What kinds of purpose might lie behind the devising of a plan and the building of an institution from it? First, might be the desire to copy the success of another institution. You might wish to begin a new and successful business. If this is your purpose, you would want to copy an existing successful business as

nearly as you could. Any deviation in its structure or environment might lead to its failure. So, each difference should be examined carefully.

Another purpose might be to avoid some mistake or problem in an existing institution. You might make a change to its plan and build upon the new plan. In this case, much is copied and little is changed. There is rarely a guarantee, and often not very good odds, that a purposeful change will bring about the desired results.

Finally, you might wish to adapt an existing plan to new conditions or add a new feature or ability. Again, the effort is partly that of design and purpose, and mostly that of trial, error, and luck. If the change works, it will be copied. If not, it won't. The process is evolutionary. But **social** evolution is capable of being much more rapid than biological evolution (even though it may be slow in terms of a single human lifespan). A responsible social engineer should keep in mind that some aspects of the institution should evolve very slowly, even while others may be allowed or encouraged to change more rapidly.

The fewer changes to a plan that has succeeded before, the more chance it will succeed again. First be sure the new plan does no harm; then try to effect some good.

All of what we are today, ourselves, our ideas, and our institutions has emerged out of our ancient covenant. We must recognize the dual nature of our reality: Our subjective nature and the objective truth of the universe around us. No discourse or action can be considered authentic, except to the extent that it makes explicit, and preserves the distinction between, ethics and knowledge, values and truth, politics and science.

# VII. The Future

The future is the way the universe will be after a chain of events has taken place. The outcome of a given, single event may be almost certain. The outcome of other events, especially a long chain, may be obscure until the events are actually played out. This chapter prognosticates about future technology and people, but its real purpose is to describe what can we do as individuals to make the best out of today in order to build a better tomorrow.

## Future Gadgets

Materials technology, electronics, and computer science are all maturing technologies. As a technology matures, it enjoys a period of exponential growth. This means that the next 10 to 50 years will be the "gadget years." Within 10-20 years most of us will have what a few have now, a home computer that remains on at all times, answers our phone, takes messages, exchanges electronic mail that will include voice and pictures, and acts as a fax machine.

As the years go by it will be more common for home computers to **network** and include the myriad other computer controlled gadgets around the house (such as the VCR, stereo, switching and monitoring systems, security system, lighting, heating, coffee maker, and your wake up call). Computers will come with much better displays, and have a graphics pad instead of a mouse. They will have speech and music capability to feed into your stereo, and video to feed into your High Definition TV. Eventually homes will have sound pickups that go to their computer and speakers that their computer can activate individually. As time goes by, speech recognition will get better and within a hundred years, you will be able to contact or leave a message for anyone you know, or control any household device, just by speaking "through the computer."

Within a hundred to a thousand years materials technology and bioengineering will have truly worked miracles. Gene repair will become commonplace and the diseases that only strike "certain" people will be curable. People will routinely live in good health to the age of well over a hundred years.

Needles and thread, nails and staples, will be things of the past. Various kinds of glues will be used for everything from sutures to rivets. Screws, nuts, and bolts will probably endure forever, being reversible fasteners, but certain kinds of glue-like substances might replace zippers, Velcro, and buttons. More things will snap together, fit better, and utilize better materials.

Artificial "muscle fibers" will be used for everything from lifting elevators to powering robots. Fabrics, metals, and plastics will all be another order of magnitude lighter, stronger, and more durable.

Transportation will be computer controlled with part of the job done by your onboard computer, and part by central computers that control all the vehicles within their cell. You will travel everywhere in two to five hundred years in a single ADV (all destination vehicle). It will attach legs for bare terrain, wheels for streets, controlled highways and tunnels, and will attach itself to trains, planes, and sub orbitals, but not to spaceships. You will have to park your ADV in orbit (after boosting from a suborbital) in order to

board a spaceship. Spaceships will be the only vehicles left that resemble the inside of today's planes or ships.

People will carry around PETs (Personal Electronic Technology) instead of wallets. Your PET will serve all the functions of your present wallet, but electronically. It will handle monetary exchange, serve as a cellular phone, and contain the security codes that enable you to come and go from secure areas such as home and work. It will act as compass, navigation system, time keeping system, calculator, and portfolio of family pictures. It will have a scribe that can be removed so that you can write and draw into it, and it will communicate with voice and speech as well as pictures. When you are away from your own home computer, it will act as your primary link to it. When you are faced with a strange computer, it will inform that computer of your standard preferences (your computer environment). Backup and security will be automatic and very effective. Muggings will be rather difficult, since you will be able to key in a "duress" code instead of your normal code, when attempting to obtain cash. Lost data and petty computer crimes will be rare. Major computer crimes will be even more major, however.

Technical changes will be vast, especially in the entertainment industries. The costs of making movies will come down drastically and the number of movies will go up exponentially. After one or two HDTV standards have caused us all to replace our video systems a couple of times, a new system will be developed that will enable video material to be transmitted and stored in a very compact form.

Most of what you see in a movie will be computer generated. In 20 to 100 years, or so, a feature length film that appears to have live actors and real scenery will be entirely generated by computer. We won't just be colorizing old black and whites, we will be starring "dead actors" in new movies. In 10 to 20 years, the equipment to produce a professional video (by today's standards) will be within the purchasing power of a normal home. The composition and production of music and music videos will be even easier, and the amount of material available will guarantee that most people are fully saturated with medium to low quality art at bargain basement prices. On our behalf, our PETs will go out over the network and search for information and entertainment that suits our individual taste and meets the requirements of our pocketbook.

## Future People

All these gadgets may sound very nice, but the bad news is that man's nature will change very little in the next two or three hundred years. Over the next several hundred years, the rich people of the earth will become richer and more powerful. The poor will remain poor, and become more angry. The number of really stupid acts of anger and desperation will increase, generally keeping the conditions of the poor and disenfranchised about as bad as they are today.

Some simple arithmetic makes the fate of mankind in the next 100 to 150 years quite clear. Let's subdivide the human population into four groups (each with 5-letter names): Asian, Black, Brown, and White. Asians occupy most of Eastern Asia. Blacks occupy most of Africa and significant fractions of the Americas. Browns occupy most of the Middle East, India, the Mediterranean, and much of the Americas. Whites occupy most of Western Asia, Europe, and much of North America. Rough numbers for these groups are: Two Billion for Asians, and about one Billion each for Blacks, Browns, and Whites.

Now, let's assume that nothing limits the current tendencies of population growth. If so, each group would double its numbers as follows: Whites in about 40 years, Asians in about 35 years, Blacks in about 30 years, and Browns in about 25 years. This means that in a little more than 100 years from

now, the world population **should** be 48 billion people. It would be composed of 16 billion Asians, 16 billion Browns, 10 billion Blacks, and 6 billion Whites.

That's if there were no limits to growth. However, that's not true. A more likely demography would be: 5 billion Asians, 4 billion Browns, 2 billion Blacks, and 5 billion Whites, for a total of about 16 billion people in the year 2100. That's 32 billion fewer people than would then be alive if nothing affected the natural birth and death rates.

So, what **will** change the rates? Where will the missing people go? Most won't even be conceived, because their parents or grandparents will have died of "poverty" (during child birth or from famine or disease). War in poor areas (both large-scale and urban) and auto accidents in richer areas will account for equal shares of the remainder.

What about the long term, say a thousand years? By that time about half the world will be "brown," mostly from racial mixing. The groups we call Black, White, and Asian, today, will make up fairly equal portions of the other half. Of course, each group will still contain dozens of minorities clinging to their original cultures and heredity, and this will likely continue to be the case for thousands of years.

Intermarriage will increasingly insure that much of the population will have all four of today's racial groups as their ancestors. In the second half of the next millennium, birth control will allow the world population to stabilize somewhere between 20 and 30 billion, and less than 20% of the world's citizens will have a quality of life worse than a middle class U.S. citizen of today. But, this half-way acceptable situation won't come about for another five or six hundred years!

This prognostication is based on guess and "by gosh." First, "by gosh!" People change very slowly. Biologically, we will evolve almost not at all in the next thousand years. Socially, we will evolve much less than we will technically and scientifically. This means that most of the advantages and progress will accrue to the keepers of science and technology. These will largely be the descendants of those who have it today.

Now the guesses: Major war is a thing of the past. Future wars will be urban wars and ones like the Gulf War. They will occur less and less frequently as the leading nations become better at local and international law enforcement. If it becomes clear that power works best when it is more evenly distributed, and this becomes an objective for international intervention, then my guess is that few, if any, nuclear devices will ever be set off in anger.

On the other hand, if unstable areas of the world do support the concentration of power in totalitarian hands, and world government fails to take action, the use of technology could permit a severe deviation from the course outlined here.

Within a few tens of years, there will be three kinds of political status that a country can have within the world community: A leader nation, a follower nation, and a renegade nation. There will be two poles of economic status: Isolation and interaction. Each of these will have its parallel with neighborhoods within cities.

The leader nations will interact with each other strongly. Some follower nations will, others will not. Renegade nations will be those that attempt to impose their will, or the consequences of their own faulty "choice" of leaders, on some other nation. In some cases the leader nations may ignore the renegade nations, in others they will take action. These decisions will not always be consistent or logical.

Political boundaries will change, but mostly among the smaller, less stable nations. Splits and divisions will probably be the rule. Empire building is probably a thing of the past for the larger and more advanced nations of the world. Once in a while we will see small pieces of land being absorbed into larger ones, but generally through choice. Political boundaries will become less important and easier to cross.

The structure of politics will change. With less importance attaching to state and national boundaries, politics will more and more be about the administration of assets, and less and less about national power and hegemony. Some assets are fixed in place and others are movable. The more mobile an asset is, the more global its politics will become. Those that are fixed in place will migrate over time to geographically nearby political structures.

## The Information Revolution

There are several forces at work that our future has to consider and come to grips with. Some of these forces are inexorable, such as population growth, consumption of natural resources, production of waste and pollution, and generation of excess heat. Others are unpredictable such as the possibilities of atomic or conventional war, escalated terrorism, or some charismatic movement that causes a major transformation in the social or economic status quo.

Human nature includes several socializing forces or tendencies that interact with the realities imposed by humanity at large. One is our tendency to identify with something larger than our self. This may be our nation, our race, our religion, or our leader. Another tendency is obedience and submission to authority. This tendency is expressed even by people involved in anarchy, revolution, or other opposition to conventional authority, having been swept into the charismatic current of some cult authority calling for obedience to an unconventional cause.

Another factor that will affect the future is the information revolution. This revolution has several components and "causes," and it will have a number of effects. It consists of computers, the communication infrastructure, and the media industry. So far, it has created two concepts: Virtual Reality and Cyberspace. Neither of these has affected the daily lives of most of us, but in a matter of a few dozen years, they will affect the average person on the Pacific and North Atlantic Rims.

Let's define these terms as best we can with the brief exposure we've had to them so far. Cyberspace is a "universe" consisting of communication and information. It is supported by, or exists within, a network of computers with which people spend a large part of their time interacting. When the primary interaction between these people is via the computer network, their reality begins to be contained more in "cyberspace" than it is in physical space.

The concept of cyberspace leads to "virtual reality." At first, a large amount of time is spent using a computer network instead of physical space to communicate with machines and people. Then, an even more complete set of sensory inputs is generated by the computer and fed from the network. Instead of just words and pictures on a screen, a person is surrounded by a more complete set of sights and sounds that are generated by computer. This sensory environment is totally fabricated by the machine. You can also **act** within this environment by using your voice and various tools and controls. This is a **virtual** reality.

In the future, the parts of the human whole that are comprehensible to a single human being will become an ever smaller fraction. But, they will be interrelated better by the action of computers. Higher

level comprehension of a nature unknowable to individual humans will take place within a cyberspace supported by a vast computer network and consisting of thousands of human beings.

In another 20-200 years the information revolution will have linked millions of people into the symbiosis of man and cyberspace. All of what we now know as the "paper" industries will be completely managed and performed by computers. This includes administrative jobs, clerical jobs, the gathering, reporting, and communication of information, and many of the current levels of management and other face-to-face jobs whose purpose is to interface individuals and organizations. Of course, these changes will involve only the vanguard of human society, distancing it even more from the rest.

## Betting on the Future

We routinely bet our lives that some future event (like the sun coming up tomorrow) is more probable than another (like a sudden drop in temperature to minus 400 degrees). You and your insurance company probably have an ongoing bet that you won't get killed the next time you go out in your car. The future can be regarded as a gambler regards a game. Life is a gamble and the living are players in the game. The near future is the number of chips you have left after the next play. Your *destiny* is to play the game according to your nature. Your *fate* depends on how **well** you play and what kind of **luck** you have.

Each action in life involves a bet. The bet may be fixed, or the amount and currency of the bet may be up to you. Each bet involves being on a side. Sometimes your side is given, other times you get to choose. After each outcome, you win or lose your bet.

Your job as a player is to bet as little as possible if you are likely to be on the losing side, and as much as you can afford to lose when you think you are on the winning side. When you get to choose sides, choose the side most likely to win, or try to "sit that hand out." If more is at stake than you can afford to lose, avoid the play if possible, or choose the safest play you can.

This strategy works in life like it does in a game, but there are important differences. The biggest difference is that you can walk away from a game and refuse to play. But, in reality, life is the only game in town. When you cash in your chips you just can't go anyplace else.

Everything you put into a "losing team" or an effort sustained out of principle, but against the odds of the situation, is up to you. Hang on to your principles, but work **with** the reality of a situation, not against it.

In life, everything you have, even your life itself, may someday be on the line. Opportunities are not repeated exactly. Life is more complex and dynamic than any game we can design. As a player in life, you are unlike every other player with respect to rules, opportunities, and the odds. Life plays favorites. Life is unfair. Life is played with many different currencies. A payoff may be in the currency of pleasure, knowledge, or something of substance.

You get to choose the value each currency has to you. Money, of course is the common currency of substance. Getting it, having it, and spending it can each be a pleasure. But, making a living is not the same as making money, having money is not the same as security, and spending money leads only to **some** of life's pleasures.

So what's the object of life? Is it to have the most toys when you die? It may seem like this is where the game analogy is headed, but another measure of success might be how effectively and well you are

able to **consume** while you are **alive**. Or, perhaps it's not the toys at all, but the **legacy** you leave behind.

## The Object of Life

Life is certainly an opportunity to rack up a high individual score, but a high team score is more important for the future of man. Life is not a *zero-sum* game. This means that many plays have a positive payoff to **both** sides. It also means that a contribution to the team doesn't have to result from a sacrifice by one of its members.

The truest measure of your life is more like the **product** of the legacy you leave behind and the amount of fulfillment you receive while living. The more equal these are to each other, the bigger their product is when they are multiplied together. If one is zero, the product is zero, no matter how large the other one is.

One of the best ways to live a "good" life is to live life as a *positive sum* game. The way to live an "evil" life is to live it intentionally as a negative sum game, taking more out of the world than you bring into it. On the other hand, intentionally being the sacrifice, giving up more than you get, choosing the wrong side of the odds, or being a martyr, is not living life with a positive sum expectation. This is the poorest of ways to try to be "good."

## Having a Good Future

To live the good life, or to live life as a good person? That is the question whose answer may point to a good future. Are they two different alternatives, or can they be accomplished together? The good life has to do with how **well** you consume; a good person leaves behind a **worthwhile** legacy. A **good future** is one in which you manage to do both.

The moments of "wonder, discovery, and joy" that you experience in life are the measure of how well you "consume." Consuming has very little relation to how much money you spend or how many resources you destroy. Consuming much and consuming well are two different concepts. So, focus on consuming well. Don't spoil your appetite and appreciation for things by consuming too much of them.

What's a "worthwhile" legacy? One simple, direct, answer is to evaluate what you **contribute** in exchange for what you **consume**. In other words, what do you do for a living? Have you helped raise a family? Your career accomplishments and lifetime achievements build the legacy you leave. It's the effect you've had on the **people** you leave behind, not necessarily the wealth or artifacts.

## People and Institutions

Institutions consist of people. People serve institutions that **do** exist, not those that **should** exist. Both people and institutions are the entities whose populations make up society. However, people evolve slowly and society is changing very fast. Institutions have been adopted by people for protection against a changing society like clothing was adopted against the effects of changing weather.

Society — humanity — is a population, not an entity. It can't tear down and rebuild. It can't remodel. It must **evolve** to change.

Society is changing because of technology. Technology has permitted us to feed more people, to interact more effectively over much more of the world's surface, and to pile up considerably more material wealth in the form of an infrastructure than in the past. The rate that this has been going on has increased for several hundred years.

The contributions of individuals fuel the forces of change. They are made through establishing, and serving, institutions. There are many, many kinds of institutions in our society. Each one was born of a plan based on other institutions, and each had its own unique charter.

At some point, an institution arrives at the end of its useful life. It's usually easier to "shut down" an institution that no longer serves a useful purpose than it is to reorganize and rebuild it. This may not seem obvious, but it's like tearing down an old house to build a new one. There's only so much you can do to remodel it. Another analogy is with trying to extend the life cycle of a person using transplants. Ultimately, all things must pass away.

Many species of institutions are long lived and quite resistant to change. The nations of the world differ from one another in how quickly their institutions evolve. A high rate of technical change goes along with rapidly evolving institutions. Rapid change causes rapid evolution, and only evolution can accommodate the change.

The rapidly changing world of today needs to focus on institutions. Very large institutions need to be taken apart and replaced with smaller ones. Institutions, very slow to change, need to be put through an "end of life." We have to enable productive turnover of institutions. We need the engineering technology that will support the design of institutions. We also need to focus on the people who serve institutions. They need to be protected and insulated from the effects of change and the life cycles of their institutions.

## Institutional End of Life

It's interesting that so many of people's greatest accomplishments are made when they are still young. Could this be due to the fact that people tend to become more **risk averse** as they get older? Institutions certainly do! Part of the life cycle of institutions involves the classic syndrome of "corporate risk aversion" when they reach a certain stage of maturity. Many, by this time, are also very big and powerful. An economic tsunami might result if they were allowed to suddenly collapse. The problem is that we have no way to "retire" an institution with dignity and grace.

Institutions come into existence with a charter — a purpose for being. This purpose grows dim eventually. A clear sign that they are ready for retirement is when they turn into nothing more than bureaucracies. Evidence of this stage is survival for its own sake. This can start with the "bureaucratic mentality" of an individual, grow into a department, and gradually infect the entire organism. We need to develop some kind of antibody to combat institutional infections of this type, or ways to "put the poor beast" out of its misery, if it can't be cured.

Institutions always arrive at a point in their life cycle when they are fat, complacent, and self-serving. When they were younger, each step was taken on the basis of where they wanted to go. When they become old, each step is taken more on the basis of where they are. Choices become more and more limited. Too much is at stake. At some point, the available options offer no opportunity that can be exploited. Further progress is mired down in more problems than there exists energy to solve. Under

the right conditions, a long period of “holding on” may be followed by a period of sliding back. An end is inevitable, but the final stages are not preordained.

## Our Challenge

It’s easy and natural to assume that in the absence of revolution, social and political structures and procedures will evolve, changing existing institutions into new forms with new uses. Human society must be permitted to evolve without waiting for the human species to evolve. This is not possible in lower animals, their societies have little, if any, structure. The individual is essentially the basic unit of their entire species.

If institutions are to evolve, they must die and be born. Can this be done without revolution? During their lifetimes, institutions do not evolve, they mature. When an institution dies, it can die of “natural” causes, or be “killed” in a revolution. Institutions are of **our** making, so “natural” causes can mean anything we **want** it to mean. Small businesses die of natural causes when they fail to make a sufficient profit and run out of funding resources. They are the perfect model for how we should design all our other institutions, but transferring intent into design isn’t quite so easy!

Natural evolution occurs with entities that have finite lifespans and are created in an ongoing copying process. In the western world, we start new businesses and corporations and the old ones go broke in a cycle that isn’t too different from human lifespans. This cycle very much follows an evolutionary pattern. Historically, when this pattern has involved governments, it has also involved revolution. Although the “rules” of evolution do apply to social institutions, we can get more involved in the copying and selection processes with institutions than we can with our own genetics.

Our challenge is two-fold: First, to keep revolutions to a minimum and allow our institutions to die graceful and natural deaths; and second, to place limits on the size and power of institutions so that the impact on people of their inevitable death is minimized. Our challenge, then, is to design governments so that the principles of evolution can operate with a minimum of bloodshed and hardship to human beings.

Here is how we can begin to meet this challenge. The breakup of the telephone monopoly in the United States and the breakup of the Soviet Union prove that institutions can outgrow themselves and yet not end in a classical revolution. Of course, neither of these institutions took itself apart; minor, but bloodless, revolutions **were** required. The important thing is that these very large institutions **could** be disassembled into many smaller ones. This is one technique we must learn how and when to apply.

Let’s see if there are others. Men began forming institutions long before recorded history. At first, they were based on a few simple patterns. Tribes, religious sects, and perhaps secret societies. Later on, we developed guilds, kingdoms, trading companies, schools, and universities. Today, there are countless different species of institutions. One genus of institution has a lifespan that rivals the redwood tree: Religions. As we have already observed, another species — governments — are prone to revolution. Perhaps the most useful model of an institution, in terms of social engineering, is the modern corporation. It is fairly easy to control. It seems to have a reasonable lifespan. It matures in a fairly predictable way. And, it seems to evolve rapidly in today’s world.

In some ways, modern governments are more like populations of loosely connected departments and branches than single entities. Power is decentralized. Checks and balances exist. And, the more this

is true, the more the separate departments can lead lives of their own. This approach doesn't require any immediate or radical social change, but it should be encouraged and copied.

Evolution cannot be engineered. We can't engineer our way out of the problems we have, and we can't expect to be led out of them by a genius leader, or committee of scientists. The very best we can do is to understand evolution and help it take its course.

There are things we can and cannot do. For example, we **can** change the rules and laws of society. These changes will affect viability and growth rates of certain species of institutions. An example of something we **can't** do is predict what evolutionary effects a given change will have. At best, we can predict **some** of the **immediate** consequences of a change. As engineers, we think we understand cause and effect. But, evolution does not proceed on the basis of intention, or engineering, or final causes, or ultimate goals, or anything like this.

Two examples, and there are many others, of the effects on social history of institutions are the Nobel Prize and the patent and copyright laws that are part of Western tradition. Western society has prized individual contributions, and enabled the individual to profit from his work more than Eastern and Equatorial nations have. More than one historian has advanced this as the reason for science and technology developing faster in the West than elsewhere.

A successful society needs the mechanism that has always been present in America, namely, the potential rewards available to the entrepreneur. Because so much has been invented in the start-up garage, we need to be sure that we always have them. The society that only allows entry into the bureaucracy, and has no avenue that a creative misfit can use to move through it, will stagnate.

The principles of *evolution* govern the course taken by **history** when large numbers of entities interact. The principles of *design* may be applied when the objective is building or copying a **single entity**. Between these scales of time and numbers lies uncharted territory. Every action, like the butterfly in my back yard, has the potential to affect distant and future events. Intention only operates in well structured, robust circumstances. Diminish the circumstances or increase the time and distance involved, and intention degrades first to chaos, then to mere chance, and finally it vanishes.

We can't stop evolution, nor should we wish to. We can't steer it either. Nor, do we know where it should be aimed. If we admit our frightful impotence and ignorance in this area, we are left with very few things we should actually strive to undertake.

Perhaps the most immediate thing we should strive for is to make more people aware of the situation. As individuals we no longer control world society to the degree that individuals once did. Increasingly, we simply play roles in our institutions. They are the real players on the global scale.

Institutions must be allowed, even encouraged, to evolve. This means new ones will be brought into existence by some form of copying process and allowed to mature. When they are ready to die, we must encourage them. If they misbehave badly enough they must be dismantled. All of this should be handled by other institutions, not by individuals of great power, and hopefully not by revolutionary mobs.

Rather than trying to guide evolution toward some ultimate goal, our efforts should be focused within the framework of institutions. Through them, global disasters such as war, famine, and plague can be mitigated. We should keep our governments compartmentalized with decentralized power structures, so that they resemble a population of individual corporations, and not a giant monolith. To evolve, institutions must have a complete life cycle. We should study how the selection process affects the birthrates, death rates, and viability of various species of our institutions. We should become aware of

how the copying and maturation processes work in different species of institutions. We should learn more about how institutions come to the end of their existences, and how people can be cushioned from the effects of their life cycles.

People should be the concern of individuals. Let other concerns be those of institutions. Institutions will evolve on their own, but man can engineer their plan. Institutions can be made to protect, shelter, and provide a more stable environment for people than the unstructured tumult of society at large.

Basically, it boils down to this. We evolved long ago into social animals. Our society evolved institutions. Institutions can evolve, and have been evolving, much faster than we ourselves can evolve. It is only through the evolution of our institutions that our society can adapt to the rate of change that has come about. We must permit this evolution to occur and we should not waste effort in an attempt to guide it. Rather, we need to focus on the copying and selection processes that affect the formation and viability of institutions. We need to understand the cycle of birth, maturation, and death as it applies to institutions. These parts of the process may be amenable to cause and effect engineering. Evolution, as an overall process, is not.

* * * * *

> The last noble savage has fallen to earth. Only a few rag-tag hold outs against modern civilization remain. Their nobility has faded, their identity is following, they will be absorbed into the rest of humanity.

* * * * *

An old man lay on the operating table, his heart had stopped for good. However, his hair and toenails continued to live. Nothing had told them that their body was dead. They would continue to grow for some days. Thus it is with our ancient covenant. It is no longer viable, yet many still cling to it, and they will for years to come. Meanwhile a new covenant has begun to evolve. Can we control this process? Should we? Can evolution be steered by conscious intent? The answer to these questions is probably "no." But, that doesn't leave us with **nothing to do**!

Evolution is a journey without a goal, but it does allow, and in fact it **requires**, participation. You are allowed to vote, both early and often. **Life is <u>your</u> journey**. Everything you come to be on that journey will be woven into the fabric of the future. You can help to **power** the evolution of man, even if none of us can help to **steer** it.

# VIII. Tidbits

The epigrams that follow here are like hardy spores. Any origin we might ascribe to most of them is more likely to be a **reappearance** after a long while of lying dormant.

All intelligent thoughts have probably been thought before, what's important is to try to think them again.

## Diversions

Drink deeply, even from a cup without a handle. The handle doesn't define the cup, nor does it improve the drink inside.

A desert is naturally more peaceful than a jungle, so in striving for peace shall we turn jungles into deserts?

Why not give Nature a chance? Do we know her business better than She?

The fool sat thinking, "It's so dark inside my house! Ah, but there's plenty of sunlight in the garden. I'll just move my house out there!"

Who wins when my right hand defeats my left?

The wealthy man told the beggar of his wish to be poor. The beggar pointed out that the wealthy man had both the **means and** the desire to be poor, while the beggar only had the **desire** to be rich.

The "Fall of Man" describes four separate occasions:
His mind enabled his fall from innocence to knowledge,
No longer a savage, he fell from nobility to wisdom,
Without the favored status of God, from grace to dignity,
Finally, with maturity, he may fall from privilege to duty.

The scientists had worked for many years to build the biggest and most sophisticated computer ever. The day had finally come to plug it in and put their first question to it. The screen lit up and signaled that the computer was ready. The head scientist typed in the question, "Is there a God?" The computer, without hesitation, displayed its answer, "There is now!"

Anything that can go wrong will. When it seems that nothing can go wrong, something has been overlooked.

Every rule has an exception (this one is its own exception!).

A lawyer once tutored a student for a certain sum of money. It was agreed that payment would be made when the student won his first case. After years, the lawyer took his former student to court demanding to be paid. The student, acting in his own defense, told the court, "I never went into the practice of law, therefore the terms of the contract have not been met. If I lose this case, the terms will still have not been met. If I should win, however, the judgement of this court will free me of my obligation."

The year, the speaker, the audience, current events — there is no end to the list of things that form the context of an expression, not to mention the language used to couch it in.

"A rolling stone gathers no moss" means?

(a) Keep moving and you won't stagnate,
(b) Keep moving if you want to stay young.
(c) You can't put down roots if you keep moving,
(d) If you keep moving, you'll never own anything.

There are two kinds of people in this world, those who divide everything into two groups, and those who don't.

Each day was more wonderful than the next!

Why, this would be cheap at half the price!

That's like a dog walking on its hind legs, it's not done well, but it's a surprise to find it done at all.

If you wish to know yourself, put a check mark next to those aphorisms that you can take to heart. Put an "x" by those that you can not. Then show your copy to whom you please.

## Knowledge

He who tastes, knows!

The best ideas are common property.

If only common sense were a little more common!

From enchantment, not born of deception, comes knowledge.

Knowledge of the world is acquired only in the world: Skill from a master, logic from problems, rhetoric from discourse; but history comes mainly from books.

I may ask about a river, but the answer may be about the sun.

Learning is not the road to wisdom.

He who knows others is wise; he who knows himself is enlightened.

Lacking any real knowledge, he gave his opinion.

It's embarrassing to find out you've been quoting the time from a run-down clock.

Allow just one lie to enter and a hundred truths will prefer to wait outside.

In the deepest darkness, one small candle is enough.

Intelligence exists to measure all things.

Science begets knowledge; opinion begets ignorance.

The difference between art and science is that the best art is created in private, the best science is done in public.

Health and intellect are the two blessings of life.

Have you noticed that everyone complains of their memory, but no one ever complains of their judgement?

Curiosity is one characteristic of a vigorous mind.

Recrimination is the first defense of a weak mind.

Only a fool strives against the force of necessity.

Necessity is the mother of invention.

Fear is the mother of obedience.

Ignorance is the mother of devotion.

Nothing is easier than self-deceit.

Like a stopped clock, even a fool must be right now and then.

When you know a thing, to hold that you know it; and when you do not know a thing, to allow that you do not know it -- this is knowledge.

All that we know is infinitely less than what remains unknown.

It is better to inspire conduct than to give advice.

Knowledge derives from how much and how well the intellect conforms to reality.

Knowledge transmitted is immortal.

Minds with nothing to confer find little to perceive.

When people choose as they have been taught to choose, the concept of free choice is a deception.

Many books may be tasted, some may be chewed, and a very few should be swallowed and digested.

Faced with Nature, and regarding it as an effect, man invented God to be Nature's First Cause.

A man's very being is developed through his senses.

Awe is the beginning of wisdom.

Grant me the faith to accept the things I cannot know, the intelligence to understand the things I can, and the insight to know the difference.

A well timed story is better than a gift.

The mind is made of first impressions. When the white cloth is dyed purple it is very hard to wash it white again.

It's a waste of time to teach a fish to swim.

Truth persuades by teaching, but does not teach by persuading. It is no part of religion to compel religion.

Once harm has been done, even a fool knows it.

A wise man holds his peace in dangerous times.

Opinions, arguments, and the desire to learn are knowledge in the making.

Not every question deserves an answer.

Nothing can possess a high degree of certainty that does not have a shred of evidence.

Wisdom and malice cannot live together; science and conscience should never live apart.

The false is claimed true by a fool, the truth is claimed false by a liar.

Wisdom is not acquired by age, but by capacity.

## Observations

The first civilized pursuit is earning a living.

You can't go back and start again, but you can start now and make a brand new end.

The original purpose of self-control is so that one will not **need** self-control.

Force has no place where there is need of skill.

When justice errs it is better to save a guilty person than to condemn an innocent one.

Cream may rise to the top, but people have to buckle down if they wish to move up.

Circumstances rule men; men do not rule circumstances.

A sharp wit invites being blunted.

A rabbit, cornered by a wolf, cried out to it, "why don't you just leave me alone?" The wolf answered, "why don't you stop being so appetizing?"

You aren't truly unlucky until you become an undertaker and people stop dying.

The oven is hot, so make bread.

There's no sense in hammering cold iron.

A bee doesn't sting out of hate.

A black widow is not very impressive — between stings!

Nature is the source of all things, men are only distributors.

It takes two to have a sin.

No disguise can for long conceal love where it exists, or simulate it where it does not.

Youth is for gathering, middle age for improving, and old age for spending.

A young man's best companions are innocence and health,
his greatest fortune is his ignorance of wealth.

There is little time in opportunity, but there is always opportunity in time.

Both good fortune and misfortune are most likely occasioned by man.

Criticism is easier than craftsmanship.

A sharp sword is made from a blunt whetstone.

The greatest guilt is discontentment.

Neither an argument nor a friendship needs a reason.

People often grudge others what they cannot enjoy themselves.

An ingrate may be the product of his benefactor.

Thinking to get all the gold at once, he killed the goose and opened it up only to find -- nothing.

A hunter may kill for sport, but the animal dies in earnest.

Even in the union of very sorry men there is a strength that none of them has alone.

Unlimited water is better than limited gold.

The greatest truth is kinder than the smallest doubt.

A true friend is always an equal.

It is good to have more than one iron in the fire.

Birds don't rid cattle of lice, they feed themselves.

Apply yourself too much to little things and you become incapable of great ones.

A great tree provides a great shade.

Some say he has a wonderful presence; I don't know. I do know that he has a delightful absence!

Life has most value when it has something valuable as its object.

Making money may take a long time, but losing it can be quickly done.

Following the crowd is no way to make a fortune.

Many wish for a long life, but few wish to grow old.

A woman is like a magic trick, most admired when least understood.

All great beauty has some strangeness in its proportions.

Morality is the doctrine of how we earn the right to happiness.

Think too much and the world's a comedy, feel too much and it's a tragedy.

If you regret giving away a kiss, how are you going to get it back? If you steal one, don't expect forgiveness when you return it. And, if you don't care one way or the other, you might as well send it by messenger.

Silence is the easiest way to preserve ones integrity.

The person with no bread has no authority.

What you don't want is expensive at half the price, what you really need is cheap at twice.

Men driven by zeal become convinced by persuading others.

Better turning back than getting lost.

Much-exhibited goods have a tendency to lose their color.

There are strong shadows where there is much light.

A little late is much too late.

One never goes so far as when one has no goal.

Desire motivates more than possession; progress fulfills more than arrival.

Nothing is cheap without a reason.

What goes into a gold mine becomes gold.

When permission is granted or refused, one mainly hears the “yes” or “no,” the explanation gets little attention.

Praise makes good men better and bad men worse.

We are each of us fearfully and wonderfully made.

There is a time and place for every purpose.

Time and chance are the source of your reward.

Hard times reveal both friends and enemies, good times do neither.

A live beggar is better off than a dead king.

Fate chooses our relatives, we choose our own friends.

Be flattered both when people copy you and when they behave just the opposite.

The tree is known by its fruit.

A man is best known by his work.

Where life is not improving, it is decaying.

Talk about the sublime never gets very far from the ridiculous.

A good deed must be done on the right occasion; a bad deed may be done on any occasion.

The truth is always welcome, so long as it opposes neither profit nor pleasure.

Tall oaks from little acorns grow.

No man can take the lead in all things.

Neither an empty safe nor a bag of money is proof of a robbery.

The greater your power and wealth the more you have to fear.

To learn the limitations of kindness, put an injured hornet back into its nest.

Kindness to the hawk may be harm to the sparrow.

How one accepts a gift and the manner in which one gives a gift are the measures of a **person**, the gift itself only defines the occasion.

Put a teaspoon of wine into a barrel of sewage and you still have undiluted sewage; put a teaspoon of sewage into a full barrel of wine and now you have a whole **barrel** of sewage.

You can’t clean one thing without making something else dirty.

Virtue untested by adversity is like clay unfired by the kiln.

There can be no accord between the wolf and the lamb.

Right timing is the most important factor in all things.

This, too, will pass.

You can’t **be** happy unless you **know** that you are.

It’s better to bow down than to be broken.

None knows the weight of another’s burden.

A buyer needs a hundred eyes, a seller needs not one.

The tools of mischief are always at hand.

A hundred friends are not enough, but a single foe is one too many.

You can’t put the same shoe on every foot.

Virtue and riches seldom settle on one man.

Wisdom and beauty together are rare.

The longest journey begins with a single step.

You can’t get pears from a pine tree.

Only a precocious baby laughs as early as its fortieth day.

It is not the man who has too little, but the man who craves more, that is poor.

The cause may remain hidden even if the result is well known.

Words are easily spoken, but their retelling is not easily stopped.

Anyone can hold the helm when the sea is calm.

Deep beneath the sea are incredible treasures, but safety is on the shore.

Better safe than sorry, if those are in fact your actual choices.

Man, who cannot even make a flea, makes gods by the dozens.

We humans all share one trait -- we all make mistakes.

Where necessity enters in, the law has no place.

Enough is at least as good as a feast.

## Quotes

Everything in the universe is the product of chance and necessity.

- Democritus

I think, therefore I am. [Cogito, ergo sum.]

Common sense must be the most equally distributed commodity in the world, for even those most difficult to please in every other respect never seem to desire more of it than they already have.

- René Descartes

He that is not handsome at twenty, nor strong at thirty, nor rich at forty, nor wise at fifty, will never be handsome, strong, rich, or wise.

- George Herbert

There is a natural aristocracy among men. The grounds for this are virtue and talents.

There are always two political parties:
(1) Those who fear and distrust the people, and wish to concentrate all powers in their own representatives, and
(2) Those who identify with the people and consider them the safest, though perhaps not the wisest, depository of the public interests.

- Thomas Jefferson

The founder of civilization was the first man who, having fenced in a piece of land, said "This is mine," and found people naïve enough to believe him.

In the strict sense of the term, a true democracy has never existed, and never will exist.

Good laws lead to the making of better; bad ones bring about worse.

The body politic, like the human body, begins to die from its birth.

Remorse sleeps during prosperity and wakes during adversity.

- Jean Jacques Rousseau

No testimony is sufficient to establish a miracle, unless it would be even more miraculous if the testimony were false.

- David Hume

It is impossible to dissociate language from science, because science always involves a sequence of phenomena, abstract concepts which recall these phenomena to mind, and words in which the concepts are expressed. To call forth a concept, a word is needed; to portray a phenomenon, a concept is needed.

- Antoine Laurent Lavoisier

Divide and Conquer.

- Machiavelli

When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it in numbers, your knowledge is of a meagre and unsatisfactory kind.

- William Thompson (Lord Kelvin)

Men never do evil so completely and cheerfully as when they do it from religious conviction.

Justice without strength is helpless, strength without justice is tyranny. Unable to make what is just strong, we have made what is strong just.

- Blaise Pascal

Life well spent is long.

Shun work whose results die with the worker.

It is easier to resist in the beginning than at the end.

Citation of authority requires not intellect, but memory.

- Leonardo da Vinci

Oh, what a tangled web we weave, when first we practice to deceive.

- Sir Walter Scott

A rose by any other name would smell as sweet.

- Shakespeare

Little strokes fell great oaks.

Necessity never made a good bargain.

There never was a good war or a bad peace.

Three may keep a secret, if two of them are dead.

Keep your eyes wide open before marriage, and half shut afterwards.

Early to bed and early to rise, makes a man healthy, wealthy, and wise.

- Benjamin Franklin

From now on, I'm thinking only of me.

But, Yossarian, suppose everyone felt that way?

Then I'd certainly be a damned fool to feel any other way, wouldn't I?

- Joseph Heller, Catch-22

## Government

Government, in its best state, is a necessary evil; in its worst state, an intolerable one.

In planning for posterity, remember that virtue is not hereditary.

In a free government no man should be trusted with enough power to endanger the public liberty.

Vigilance is the price of freedom.

Without the liberty to know, and to freely speak one's conscience, liberty is sorely curtailed. Eliminate liberty and you offer only death.

Mercy to the criminal may be cruelty to the people.

Those who are enslaved to their sects are not merely devoid of all sound knowledge, but they will not even stop to learn!

Fanaticism is little different from barbarism.

When bad men combine, the rest must band together, or fall one by one as sacrifices in a contemptible struggle.

Running a large organization is like cooking a small fish. Too much handling will spoil it.

The crop planted by slavers is harvested when the descendants of the slaves have become democratic equals, and those of the slaveholders have become just another minority.

The strongest nation is the most diverse whose people can still work together for their common good.

Freedom of speech is when the voice of reason and the mistaken opinion are always allowed to do battle on neutral ground.

Freedom of the press can only be restrained by a despotic government.

A person with the right to participate in government has the duty to rise above ignorance.

Others may deny your rights, but only you can deny your duty.

Ignorance of the law is no excuse; if it were, it would be every man's excuse, and there would be no refuting it.

Justice and rights should never be sold, denied, or delayed.

A jurist's first responsibility is to see that the innocent go free, having assured himself of that, his responsibility is to convict the guilty.

Let the punishment fit the criminal:
Death for the incorrigible,
Confinement for the assailant,
Bondage for the thief, and
Humiliation for the abuser of power.

Having broken a bad law, and having done no injury, a person may yet be innocent.

Only the good seek liberty, the rest seek license.

A man's compact with society obligates him not to trespass on his fellow citizens.

All men fulfilling their compact with society have the right to the enjoyment of life and liberty, and to the means of acquiring and possessing property, happiness, and safety.

People cannot be content whose property or honor are under threat.

## Instructions

O mortal man, think mortal thoughts!

Choose the course that is easier for **you**:
Abstinence, or
Temperance.

When the road is steep or bends sharply, take short steps.

If you would enjoy the fruit do not spoil the blossom.

Ask how, not why. Work out what **must** be, not what **may** be. Be a little crazy, but never stupid.

Don't mud-wrestle with pigs; you get dirty and they enjoy it.

Talk sense to a fool if you wish to be called foolish.

Leave a good name behind in case you return.

Well begun is half done. Badly begun? Start again.

To be a person of principle, first be a person of courage.

Be just before being generous.

Before you love God, love all living things.

Neither a borrower nor a lender be.

Never spur a willing horse.

Give a grateful person more than he asks.

Don't put the cart before the horse.

Be most afraid of fear itself.

If you bow at all, bow low; he who knows not how to flatter knows not how to rule.

Make your peace with the spirits of the tribe, the cave, the marketplace, and the theater.

At the beginning of a cask and at the end take your fill; in the middle be sparing.

A physician can only treat you, you have to cure yourself.

Beware the remedy too strong for the disease; some remedies are worse than the disease.

Love your neighbor, but don't pull down your fence.

Do not what the law allows, but what reason, justice, and humanity advise.

Strive to position yourself beneath envy, but above contempt.

Don't speak ill of the absent.

Treat others the way you would be treated.

To make a fortune, cultivate luck as well as ability.

Watch out if your ship carries more sail than ballast.

Don't beat a dead horse.

Don't look for this year's bird in last year's nest.

Don't cure the disease by killing the patient.

Strike while the iron is hot.

Don't stand in your own light.

Don't put all your eggs in one basket.

Be not careless in deeds, nor confused in words, nor rambling in thought.

Keep big promises distant, small rewards frequent, and focus on the journey underway.

Seek happiness in beginnings and satisfaction in endings.

## Definitions

The Fundamental Principles of Design:

1. Keep it simple — components, connections, concept.
2. Go with the flow — Nature, trends, human factors.
3. Consider the life cycle — production, numbers, support, and disposal.

Sickness: The messenger of death.

Anger: A brief period of madness.

Hate: A prolonged form of suicide.

A fool: Someone trying to be honest with the dishonest.

An intellectual: Someone who knows no craft.

A penitent: Someone incapable of enjoying himself.
History: The portrayal of crime and misfortune
Newspapers: A microscope over history in the making.
Reporters: Cats waiting at a mouse hole.
Patriotism: The last refuge of a scoundrel.
Wisdom: knowing what to do next.
Skill: being able to do it.
Virtue: doing it.
Mathematics: A language evolved by man to describe the universe.
Evolution: The author of authors.
Riches make a good servant, but a bad master.
Hope makes a good breakfast, but a bad supper.
Drugs provide the epiphanies of the ignorant.
Worry can make a healthy person ill.
Knowledge is power.

## Old Sayings

Haste makes waste.
Still waters run deep.
A stitch in time saves nine.
Variety is the spice of life.
There's no fool like an old fool.
Beggars can't be choosers.
Half a loaf is better than none.
A bird in the hand is worth two in the bush.
You can't make an omelet without breaking an egg.
In the kingdom of the blind, the one-eyed man is king.
You can't have your cake and eat it too.
April showers bring May flowers.
Life is but a dream.
Every cloud has a silver lining.
It is always darkest before the dawn.
Beauty is in the eye of the beholder.
Two heads are better than one.
A miss is as good as a mile.
Possession is nine-tenths of the law.
You can't cheat an honest man.
To err is human, to forgive divine.
A word to the wise is sufficient.
Hell hath no fury like a woman scorned.
Birds of a feather flock together.
A man's home is his castle.
Parting is such sweet sorrow.
Rank has its privileges [RHIP].

Rank has its obligations [noblesse oblige].
United we stand, divided we fall.
The pen is mightier than the sword.
No man is an island.
Familiarity breeds contempt.
Every dog has its day.
Living well is the best revenge.
Honesty is the best policy.
Silence is consent.
Beauty is only skin deep.
One good turn deserves another.
In God we trust, the rest pay cash!
Once burnt twice wary.
People who live in glass houses shouldn't throw stones.
When you lie down with dogs, you get up with fleas.
The road to hell is paved with good intentions.
Many hands make light work.
An ill wind blows no good.
Silence is golden.
Though I condemn what you say, I defend your right to say it.
Mysteries are revealed to the meek.
Pay peanuts and you get monkeys.
People do not acquire fortunes, fortunes acquire them.
Money talks in a language all men understand.
Money is like manure, it works best if you spread it around.
What's worth doing, is worth doing well.
Give me fresh coffee at sunrise and old wine after dark.
A man is known by the company he keeps.
An honest man's word is as good as his bond.
All that glitters is not gold.
Ask me no questions and I'll tell you no lies.
All work and no play makes Jack a dull boy.
A fool and his money are soon parted.
Nothing ventured, nothing gained.
All's well that ends well.

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