On the Semantics of Evolution

By Ray Cruz

A definition of evolution from the Merriam-Webster Dictionary online includes this statement: "…a process of continuous change from a lower, simpler, or worse to a higher, more complex, or better state." The etymology of evolution from the same source is "Latin *evolution- evolutio* unrolling, from *evolvere.*" We understand the evolution of species to be a gradual progression, one that normally takes thousands or millions of years to develop a new species from ancestral origins. What we see today, however, since the advent of agriculture, is a greater dynamic level of evolution, one that differs profoundly from pre-agricultural times. To better understand this new *evolution of evolution* we will examine and try to clarify the rudiments and semantics of classical evolution theory and the issues that abound from common terminology. We will also introduce some new concepts and terms that are needed to better understand human-manipulated evolution. The new concepts include *super-intelligence*, *artificial selection*, *agevolution* and a *comprehensive, four-dimensional model* of evolution.

Traditional Concepts

Evolution is often discussed in terms of genes that 'solve problems.' The term 'survival of the fittest' is the classic view in which evolution has been traditionally perceived. These terms and others used by modern science writers and lecturers are laden with unintentional or questionable values and connotations.

To indicate that certain genes or features that resulted from evolution solved a certain problem implies that a problem was somehow perceived to exist from some point of view. What was the problem? Who perceived the problem? For example, was it a problem for fish or other sea inhabitants to be unable to walk

on land before the first land animals evolved? Is it a problem for one animal to be the prey of another? Does nature or some other force or intelligence see this as a problem? Is one species' opportunity, another species' problem? Or, from the human standpoint, is it a problem or an opportunity for us to eat the eggs of chickens?

The concept of problems is an anthropomorphic view of the way humans think. Evolution doesn't have problems. Evolution doesn't favor one species over another. Neither the predator nor the prey presents a problem. Most scientists understand this and defend the randomness of evolutionary changes, and yet it is still common to see the process of evolution described as solving problems.

Solving problems implies a purpose. What is the purpose of evolution? Does evolution exist to solve problems related to survival of a species? Most scientists today deny any purpose in evolution. Gene mutations are random. Some of these changes allow the changed species to take advantage of environmental features that may result in better adaptation and survival within the environment at hand. Many of the changes are detrimental. Some have only temporary advantages for the species at hand. Some changes, if not most changes, are catastrophic. These go unnoticed from the eye of history because by their quick demise the forensic evidence leaves hardly a trace of their very brief experimental trial.

Saying that a certain gene or trait 'evolved to' accomplish a beneficial adaptation to the species is another way of implying value or purpose in the change. For example, a recent article in a popular science magazine included this sentence: "TLRs, it is evident, evolved to recognize and respond to molecules that are fundamental components of pathogens." [1] Was this just a careless use of terms, or did the author actually mean to say with the words 'evolved to…' that evolution was purposeful in providing additional defenses against pathogens by providing a

[1] O'Neill, Luke A. J. 2005. Immunity's Early-Warning System. Scientific American 292:38-45.

variety of useful TLRs? (A TLR is a Toll-Like Receptor that attaches to invading microbes in humans and other species.) If so, why would evolution favor the defense of one organism over another? Does evolution favor the prey or the predator or neither? We have taken this excerpt out of context only to focus on issues of semantics, and not as a reflection on the main content or conclusions of this article. This is only one example out of many in current scientific literature that raises issues of semantics. The phrase 'evolved to' may not necessarily connote purpose to some readers, but such interpretation is one that may be assumed by many readers.

When we talk about survival, we are also implying a value to some of the species that may have been more effective in consuming or bringing about the destruction of competitive species. The 'fittest' are those species who succeed in direct competition with their contemporary adversaries. When the mutual environment changes, however, the competitive edge of one species may be compromised in the favor of another. We saw this happen at the end of the Cretaceous period, about 65 million years ago, to the demise of all the magnificent dinosaurs that ruled the surface of the land for 70 million years or so. Their great size was an advantage in one environment, and when the environment changed, their size and feeding behaviors became a critical disadvantage.

If we argue that the environment is always changing, which is true, then the advantages that evolve and that happen to suit the conditions at any given time should also be seen as temporary. So the two millions of years of hominid species survival should not be seen as any great evolutionary accomplishment in comparison with the 70 millions of years of the dinosaur's survival.

We humans have survived a couple of minor and major ice ages. We know that more are coming, possibly within a few hundred years. We know that global warming is apparently out of control and a product of our own machinery. Are we

the ultimate end of evolution, or just another temporarily successful experiment that worked for a couple million years? More importantly, is there any one ultimate end of evolution? The largest animals or plants? The most intelligent? The most prolific? The most adaptable? Since ninety-nine percent of all species have become extinct, does that mean that evolution is only one percent successful?

It's impossible to think about evolution without the concept of survival. It's also nearly impossible to think about survival without the implicit value of the superiority of those species that survive. If we discipline our ways of thinking, we can understand that evolution is a process of change at the molecular level that offers an equal opportunity for a given species within a range of environmental features to either flourish, survive, diminish or catastrophically cease to exist. If there is some value to those species that live today or even that lived perhaps a few million years longer than other species, this value is one of our own contrivance, not one of the natural evolutionary process itself.

Since our species is the only one on this planet at this time that is capable of thinking retrospectively, there certainly is no reason for us not to value this amazing capability. Our egotistical perspective should feel no embarrassment in touting the value of intelligence. Certainly, the human species is a marvelous animal with capabilities that can in many ways outdo most other species. The ability to think, solve problems (and ponder problems), communicate, create tools of profound complexity, defend ourselves against many types of threats, care for (and destroy) many other species, manipulate the environment at the global level, travel into space, and even directly tinker with the building blocks of evolution at the molecular level, are worthy accomplishments all brought about by the intellectual capacity we acquired through the random effects of evolution.

Evolution has the mechanisms based on random alterations in DNA sequences to modify the most miniscule level of physical structure and behavior in all types

of species. As we know, the more complex organisms generally evolved from simpler ancestors. Since the DNA templates of evolution are capable of retaining the structures of extremely complex organisms, in time some very complex organisms are bound to evolve. So it is the capacity for retaining the structural templates of complex organisms that ultimately results in the evolution of so many fascinating and complex organisms, although completely by random and fortuitous changes that accumulate over time.

Complexity and Intelligence

The capacity for complexity in evolution does not necessarily favor complexity or give any inherent value to complexity. Many of the simplest DNA permutations have survived for billions of years without any enhancements. The more complex organisms that we see today are not necessarily any more efficient or capable of outlasting the more simple microbes. Some of the species that failed to survive other environments in the past could possibly thrive very well in the ecology of some parts of our world today.

Millions of years ago, the brains of simple animals were initially effective in supporting movement in directions that turned out to be beneficial to the survival of these species. The crudest neural system requires a rudimentary motor element and some kind of sensing organ. Simple organisms were able to move towards certain objects or away from certain objects, or both. Whether by sensing sound or motion or heat or light, the information was processed in such a way as to support navigation that was beneficial to this animal.

There were a variety of advantages for both improved senses and more accurate or faster motion. Random changes resulted in occasional advances in deliberate mobility. More senses allowed the animal to perceive and recognize more objects or situations that could be either beneficial or harmful. To process the information from more senses and more refined senses, the neural structure had

to make more connections. To perceive motion in any meaningful way, the crude brain also had to retain a rudimentary memory of several time-sequence snapshots for at least the very near past. This short-term memory is also very helpful in navigating around the immediate environment. For functional navigation, the animal needs to know it's own progress as it moves away from or towards other objects.

Increased complexity in the ability to sense, remember and respond to sensations had a tendency to often result in adaptive features that gave some species an advantage over other species, especially with regard to competition for food or other resources. Since memory is a critical process in navigation and perceiving the motion of other objects, improvements in memory were often advantageous to new mutations. The ability to distinguish friend from foe, and relative from stranger also resulted in strategic advantages for more complex animals. This ability was also enhanced by an even greater amount of senses and memory and information processing capability.

Many species can also communicate with other animals by making sounds and gestures. Some mating rituals also involve complex behaviors, sounds and even aggressive actions. All of these behaviors are facilitated by more sophisticated brains. So it is not difficult to understand the stepping-stones of the evolution of intelligent animals. There is really no mystery in how or even why this occurred.

The more sophisticated animals also have the ability to learn. Some primates today even teach cultural behaviors to their young. I can also teach some of my neighborhood wild cats to trust me and allow me to pet them. They have the ability to distinguish me from other humans and to remember something about my treatment of them in the past. A certain type of relationship can thereby be established based on learning and interaction between members of two widely different species.

Linear Progression

The analytical perspective of the human mind tends to look for linear progressions. We see the pattern of increased intelligence in our lineage of evolution and we recognize this as a pattern of progress. This pattern stands out as significant to our understanding of evolution. What we fail to recognize is the pattern of simpler, less intelligent species that also may have evolved from more intelligent ancestors. Is it possible that some less intelligent species evolved from more intelligent species? Because of the randomness of evolution, it is not only possible but also very likely.

From simple to complex and from small to large are also linear progressions that we tend to analytically appreciate moreso than the reverse. However, in the case of size, it has been long accepted that in some species in isolated areas, the larger animals evolved into smaller ones, most assuredly because of environmental changes such as a greater scarcity of nutrients, for example.

So what could be the advantage of a less intelligent mutation? One possibility could be more structured behavioral patterns that may be more advantageous in some environments than others. For example, it usually takes more intelligent species longer to mature to independence than less intelligent species. Therefore, a less intelligent mutation may be better able to defend itself at an earlier age. Another example may be a mutation that resulted in more effective sexual reproduction at the expense of losing a few million brain cells. Some people might argue that our human sexual rituals are far too complex for the purpose of efficient reproduction. So evolution does not necessarily reach its pinnacle of achievement by the introduction of a super complex or intelligent organism.

Evolution can be seen as an ongoing series of experiments without any purpose, without any definable linear progression, and without the benefit of any intelligent

experimenter or force pulling the strings behind the curtain. We use the concept of experimentation very cautiously in this context and we clarify that, as opposed to scientific experiments, there is no hypothesis to be tested by the experiments of nature. If some mutations are able to survive for a few generations partially because they are more intelligent, so be it. If other mutations result in the demise of a more intelligent species, so be it. Nothing gained or lost in either case, from the perspective of the evolutionary process, unless you happen to have an interest in one of the species involved.

What evolution teaches us from an analytical perspective is that the myriad of changes afforded by evolution occasionally resulted in some new features for individual species that turned out to be amazingly functional. For example, the wings that allowed the first reptiles to fly gave new levels of mobility previously not enjoyed by any species. There was no problem being earth bound. No need to give one species an advantage over others. Yet evolution can result in changes that rival and far surpass the genius of the greatest inventions of the human mind to date.

Linear Regression

In fact, even with the successful model of aviary flight before our eyes, it took humans many years of study, trial and error to come up with functional machines that can fly using some of the same aerodynamic principals of aviary flight. If there were insufficient advantages for animals to fly, this capability would not have been repeated in the countless iterations of the same and related species in subsequent generations. Who's to say that some flying species did not ultimately evolve into non-flying species, like penguins or ostriches, for example? These species provide clear evidence of the non-linear pattern of evolution.

So today there are things with feathers that can't fly. There are also things without feathers that can fly. There are also things that navigate in space without

the use of eyes. So evolution doesn't always progress linearly. Some changes work in some situations and in other situations the reversal of such changes may be more functional. There are many examples in nature of both linear progression and linear regression. "I've got feathers, but I can't fly", may be the mantra of evolution. Or even, "I've got a brain, but I can't think!"

The success of the evolutionary process is not the use of complex engineering principals that have resulted in some super-functional species, but rather the steady though random process of minor changes that can continue to foster new features without recklessly destroying the myriads of functional advantages inherited from earlier ancestors. The process of evolutionary functional change is successful whether the outcome is a simple behavioral change, a one-cell creature that barely thrives in an isolated environment, or things that fly or swim or think about evolution.

Because we value life and the ecosystem upon which we survive, we consider this evolutionary process successful and good. Even without this added value, we must recognize that the evolutionary process is certainly effective in producing a vast array of living things that survive in today's broad diversity of ecologies.

So evolution is a phenomenon with no perspective, no purpose and no intrinsic linear progressions of quality. It is a phenomenon that brings about change and provides for minor modifications that tend to keep most of the inherited machinery in place from generation to generation. Some minor changes can accumulate within a gene pool and over a longer period of time these changes can result in evolutions that appear to be rather profound. But it takes thousands or millions of years for major evolutions to occur.

Over millions of years a number of very complex and a number of very intelligent species were bound to evolve merely by chance. But even today, a number of

simpler and less intelligent species are still evolving in the same random fashion that has existed for billions of years.

Super-Intelligence

We are a super-intelligent animal, and we have shown the adaptive advantages of our super-intelligence by being able to feed and house billions of human beings by some very sophisticated behaviors and systems in nearly all parts of the world. It may help to distinguish our type of intelligence from the intelligence of other species by using the term 'super-intelligence.' In this framework, super-intelligence predicates the ability to recognize and appreciate intelligence in other individuals and species.

When I confront the wild cats that eat food in my back porch, they always look directly into my eyes. They don't look at my feet, which are closer to them. They don't look at my hands, which are more capable of doing them harm. Instead they look at and into my eyes. They are intelligent enough to know that my eyes and my face may indicate a threat. That's the result of millions of years of evolution in animal intelligence, the same evolution that accidentally resulted in our level of super-intelligence.

To me, any animal that tends to look directly into my eyes when we encounter one another is an intelligent animal. This is an animal that is capable of communication at some level. There are moves, facial expressions and sounds that I can make that will directly bring about a predictable response from these animals. I enjoy these encounters. Sometimes, after months of careful treatment, I can domesticate a wild cat. He will then treat me like a member of his family. But he still has innate genes that make him wary. If I approach him from the stairs instead of from the door, he will panic and jump off the ledge. He can't help it. He wants me to pet him. And he purrs. And his purring makes me purr inside, as well. So not only do we share a certain level of intelligence with

other intelligent species, but we also share a certain level of emotional intimacy and compatibility, as well cultural exchanges.

Agriculture

The super-intelligence of our species, though, does not make us absolutely superior to other creatures, or to microbes or to plants. If species diversity is the highest value of nature, for example, from a philosophical perspective, the human threat to diversity may put our species high on the list of invasive and noxious weeds. We are superior in many ways, we are more intelligent, but do we have an absolute value above all other species, intelligent or not, or all other things? This is not a treatise on the value of human life, but nature and evolution may give us some interesting perspectives on this topic.

Our systems of providing food to billions of people around the world have had a direct impact on evolution. We often think of the latest steps in scientific genetic manipulations as threatening the natural order of things. For the most part, we have blindly overlooked the even greater disaster on our environment caused by the very agricultural industries that feed us. In it's most simple terms, we should understand that any change to the environment at any time is a threat to all the species that depend on the conditions of the environment prior to change. This means that pulling out one weed to plant one pepper plant is a change in the environment (and the death of that weed) that could have adverse impacts on individual plants and animals in that area. Theoretically, you could be destroying the habitat of the last remaining member of a species of bugs simply by pulling out that one weed plant in your back yard.

Multiply the impact of removing one weed by the billions of weeds and trees that are displaced by our benign crops throughout the world, and the consequences of agriculture on evolution are immense. The term 'invasive weeds' is often used in agriculture to identify plants that don't have a historical basis in an agricultural

or ecological region. Because we depend on agriculture for our sustenance, any plant that offers a new threat to the region's agriculture is promptly identified by scientists and targeted for aggressive weed control measures.

Of course, we also look at agriculture as a multi-billion dollar industry in many parts of the United States and other regions of the world. So we accept the fact that our needs for survival result in the disastrous removal of millions of acres of native flora and the consequent impact on evolution. We talk about invasive weeds, but no one talks about *invasive crops* or the *invasive human animal* that plants these crops wherever people want to live.

There are also concerns about invasive fish that come from another part of the world and that threaten to undermine the native fish in certain areas. Similarly, today there are concerns about invasive seaweeds that threaten to overtake the habitats of many native species in some regions. Evolution is triggered and impacted by any and all environmental changes at the micro and macro level in any part of the world. By far, the biggest single impact on evolution is caused by the practice of agriculture in all parts of the world. As we run out of suitable land for agriculture, we are now beginning to look at the sea for the further expansion of agriculture.

Human-Manipulated Evolution

In addition to removing native plants and habitats, agriculture also profoundly increases the number and development of favored crops. The breeding of preferred cattle is clearly a direct manipulation of evolution. We do not have to change the molecular DNA structure of a species to manipulate evolution. All we have to do is nurture one heard of cattle in order to have an impact. What hunters did to the buffalo in the western United States a hundred years ago by hunting them for furs is no more significant than the moving of herds of cattle and

sheep into these same regions shortly afterwards. This is human-manipulated evolution of the modern age.

The fact that this phenomenon of human manipulation in evolution is relatively new in the long-term view of evolution, does not in itself give it any value, good or bad. The artificial aspect of this phenomenon does not necessarily carry with it a negative value. However, if we see the survival of a plethora of species as a good thing, we may see agriculture itself as a threat, since the space and resources we overtake to produce our crops and animal protein sources are increasingly destroying additional acres of native habitat by the millions every year in all parts of the world and now soon into the sea.

Which is more valuable, greater diversity of the living species on earth or the feeding of increasing populations of one species, the super-intelligent one? Does our species also need a more diverse ecosystem in order to enhance the probability for our survival in the future? Natural evolution is a process mostly beyond our control, but artificial evolution is one that we have a responsibility to evaluate very carefully.

At the end of the Cretaceous period, a massive meteor or volcano threw billions of tons of ash into the atmosphere that darkened the sky for many months. This caused the end of the dinosaurs and accidentally, through adaptive evolution, resulted in favorable conditions for smaller animals including mammals to flourish. Human agriculture is not nearly as destructive to the ecology of the world as was the worldwide explosion at the end of the Cretaceous period. Certainly, agriculture is more selective and controlled. The selection of the species that benefit and those that are sacrificed is a careful process based on human needs. Although careful and deliberate, the evolutionary changes triggered by agriculture are arguably as great or greater than any of the changes that occurred at any time since the Cretaceous period, including the several ice ages and other natural catastrophes.

The introduction of organic agriculture promises to be more sensitive to the ecology by using less noxious chemicals and producing crops that are healthier for their consumers. This is a sign that the super-intelligent species is aware of the potential dangers of traditional agriculture. The super-intelligent species is capable of finding ways to protect as many other species as possible within the same number of acres that other agricultural methods may use. Organic growers also use benign bugs to ward off detrimental bugs. Whether one bug should be protected over another is a debatable question. But that's the same question about whether any species (even humans?) should be favored over another species. However, with organics there's a much better chance that at least some bugs and maybe also a few weeds may happily coexist with the crops. And maybe these crops will taste better, too.

Horticulture also favors ornamental plants over the native species in the regions where ornamental plants are grown. If you pass by a horticultural farm it is difficult not to be impressed by the beauty of the flowers and shrubs that grow in orderly formations. But these plants are just as destructive to the native ecology as other types of agriculture. And in the case of horticulture, you're not feeding humans or animals, except for the few families of owners and workers who grow the ornamental crops. Of course, we also do this in our own front yards. That is, we destroy the habitats of the native species in order to grow beautiful lawns and floral displays, as well as to build our housing.

The buildings and roads we put up also displace the natural habitats of millions of living things, but the amount of space used for these structures is miniscule compared with the land we devote to agriculture. Not only do we take massive areas of land for agriculture, but we also select the most fertile lands to enhance productivity. These fertile areas are the native habitats of a greater variety of species than the arid or mountainous areas we generally overlook for growing our daily bread.

Species Diversity

Most ecology advocates argue in favor of protecting the broadest diversity of species possible on our planet. As we have shown, to take this position to the extreme would eventually lead to a conflict with agriculture, as it is known today. Is our super-intelligence capable of finding new ways of growing more crops with less land as well as less noxious chemicals? Is our super-intelligence able to draw up a list of all the species we are prepared to sacrifice in the rank order of value? When we develop a list of official invasive weeds for our own region, should we not also draw up a list of native species that should be protected despite the interests of agriculture? We tend to become concerned when a native species borders on extinction, but should we not also be concerned when any native species is threatened beyond 40%-50% of its original population?

Human-manipulated evolution began thousands of years ago when grains of rice, wheat and corn were grown and harvested by the first civilizations of our species on several continents. It is not new, in this sense. To put this in perspective it is important to understand that had agriculture not been developed, we would not have billions of people on this earth today. We usually think of agriculture as the consequence of large populations of people. Which came first, agriculture or civilization in masses? The answer is agriculture.

Prior to agriculture there were people in small bands and tribes hunting and gathering in natural habitats in various parts of the world. This feeding pattern had existed for all of the two millions of years of hominid evolution up until the last ten to twenty thousands of years or so. The population numbers did not grow beyond a few tens of thousands and the civilized structures of governments and political leaders did not happen until agriculture was invented and was capable of producing an abundance of food. First came the abundance of food, then came the people in masses, and then came the civilized structures. In that order.

In terms of evolution, the super-intelligent people who invented agriculture changed the environment in such a way that allowed for the growth of larger families and larger tribes and larger villages. When you double a population, you double the chances for that species to survive. If you can manipulate the environment in such a way so as to multiply the loaves every time you need to, you can logarithmically increase the population with every generation, provided that you have enough arable land, water and sunshine. Thus the first major impact our super-intelligence had on evolution was to create a means of subsistence that we could control and that accidentally resulted in the massive explosion of our population statistics.

The term 'accidentally' is used in describing the result of the massive population explosion because there was no way for the farmers of those days a few thousands of years ago to envision the potential impact of their arts. The art of agriculture allowed one family to produce twice as much food that the family needed to consume. More food was available for humans than ever before. Soon after this art was invented, systems of storing grains and other products were developed. Next came the methods of shipping and trading and organizing agriculture. In terms of evolution, the new environment now enhanced by human inventions, was the trigger for the massive population growth, and therefore the extended survival of the species.

In its most simple terms, the survival of a species is augmented every time an individual member of this species is grown, born or nourished at least to the age of reproductive maturity. Conversely, every time a member is killed, especially at a pre-reproductive age, or not allowed to be nourished or grow, the survival of a species is diminished. Except in the greatest of catastrophes, a species is destroyed one member at a time.

Artificial Selection

To fully understand the evolutionary impact of providing essential food to a given species, we will use the contrivance of a thought experiment. The fictional island of Cuculand is void of bananas. It also has no monkeys. No monkeys can survive on Cuculand because there are no nutrients that monkeys need on the island. Along comes a super-intelligent animal on a boat laden with banana seeds. The banana seeds are planted. Banana trees grow. Now this same super-intelligent animal brings a boatload of monkeys. The monkeys multiply and become the top mammals of Cuculand next to the super-intelligent one. The survival of the monkey species was significantly enhanced by the agricultural manipulations of the super-intelligent one. This was not a natural selection, but was an artificial selection of species and location.

Suppose the monkeys on other islands and continents were destroyed by a natural disaster of some kind. Now, the only surviving monkeys are those on Cuculand. Without the cultivation of the banana trees on Cuculand, the species of monkeys would have been lost. We readily understand how moving one plant or animal to a new ecosystem can accidentally create a super abundance of that species. What is not as obvious is how the cultivation of grains in early agriculture virtually created the populations of the super-intelligent species that populate our world today. So the invention of agriculture was also the invention of the next evolution of the human species. So we invented our own evolution by creating islands of nutritious food (our farms) that never previously existed in any natural ecology.

Some people are uncomfortable about killing cows or pigs in order to eat them. The value of animal life is one that permeates our society in many ways, even though there are many conflicts and compromises. From an evolution standpoint, killing cattle that are raised to be consumed offers no real threat to the survival of that species. There are millions of cows that exist only because

the super-intelligent species nurtured them for the purpose of slaughter. Some people argue that these cattle also consume many of the grains that may otherwise be distributed to hungry people in other parts of the world. This is not the best use of limited resources, some would say.

We see here the evolutionary impact of agriculture in a different light. Without agriculture, we could not raise our preferred cattle. So the invention of agriculture also brought about the invention of the evolution of cattle that we feed for slaughter. We raise only enough cattle to satisfy the market for consumption. It is a business, after all. We slaughter only those that were raised for this purpose. The agriculture itself also takes away land from the natural habitats of native species. And now we raise the question of whether the grain we use to feed the cattle should perhaps be better distributed to feed hungry people in other parts of the world? We question the engorgement of some people with rich animal proteins possibly at the expense of the lives of others. We examine the competition between tribes for scarce resources within the same super-intelligent species.

Another thought experiment leads us to a different island, or rather two islands, Bubuland and Dudu land. A common natural disaster recently occurred and led to the death of nearly everyone on both islands except for a handful of children on Bubuland and a handful of adults of on Dudu land. The adults are beyond the natural childbearing age. We have a load of food on our boat and enough fuel to reach either island and enough to get back, but not enough to reach both islands. The amount of food we can contribute is sufficient to sustain either group for about one year. In one year, there should be other crops that naturally grow on the islands to sustain the populations at a minimal survival level. If the populations grow, starvation will most likely become a critical reality. We have to decide whether to feed the children on Bubuland or the adults on Dudu land. We do not foresee the certainty of returning to either island in the predictable future.

It is not likely that any other recourse will benefit either island from the external world.

Bubuland or Dudu land? Feeding the adults on Dudu land will most likely result in the final generation of Dudu land people when they ultimately die of natural causes. They will live longer because of the food we give them, at the expense of the lives of the children on Bubuland. They will have enough food from the island to sustain their lives as long as their population doesn't grow for the remaining years of their normal life expectancies.

Feeding the children on Bubuland will most likely result in new generations being procreated. However, the expanding population will probably suffer from starvation unless they curtail their population growth in some way. They may possibly invent a new method of agriculture that could sustain a larger population. Many of the children are young enough to perhaps have an open and creative mind with respect to curtailing excessive population growth. Because of their age, they are also ignorant of the lessons learned by older people about the logistics of caring for a family. Of course, if we feed the children of Bubuland, the adults on Dudu land will die within a few days or weeks.

The values of diversity and species survival would teach us to favor the younger population. Give them a chance to survive and procreate. Starvation is not a necessary consequence, unless they fail to learn how to control the numbers. Our understanding of ancient history does not teach us how pre-agricultural generations controlled their population growth. Was the cultural wisdom at that time aware of the negative consequences of too many mouths to feed? Did they simply sacrifice or cannibalize their infants when they were likely to lead to starvation? Our sympathies also tend to favor the caring for the children. We think of our own children. We want to care for them, protect them.

So our decision of which island gets our food, will result either in the evolutionary survival of at least one tribe of people on one island or the extinction of both tribes within one generation. We question the quality of life of the children who may suffer from malnutrition if we feed Bubuland. Trying to put our sympathies aside, we attempt to look at both populations, the adults on Dudu land and the children on Bubuland, with equal value. Why should a child be more valuable than an adult? If we save children in order to become adults, shouldn't adults have equal, if not greater value by token of the investment already made to care for them for so many years? We may not see problems like this so clearly defined in our world today, but the decisions we make in agriculture and food distribution could have profound impacts on the survival of populations in various regions of the world.

Gems of Evolution

The human invention of agriculture in the modern era has far surpassed the effects of natural selection in the evolution of species on our planet today. Decisions of food distribution, birth control and agronomy result in the life or death of many tribes of humans and the threat to the extinction of many species, including our own. Now that we have invented a new environment to sustain the lives of billions of people, the challenge is to invent new methods to prevent our excessive appetites from consuming all the resources we need for future generations and to simultaneously preserve as much ecological diversity as possible.

Much of what we do at this point in history will be based on how we perceive the value of human life and our species in contrast to the diversity of species that we threaten every time we destroy a forest to create a new farm. A lesson in humility may be gained from another view of evolution, this time from the bottom up. The human body is a host to billions of bacteria that compete with one another in some cases, but that are normally beneficial and essential to our

survival. Who's to say that, if there were a purpose for evolution, it may have been to create an elaborate array of complex organisms to cultivate and nurture the microbes from which we inherit the majority of our genes?

The microbes that survived for billions of years prior to the advent of complex organisms and to the present day may be the ultimate gems of evolution. Before the existence of complex hosts, the survival of the microbes was dependent on many fluctuating environmental circumstances, an environment much more precarious than the plants and animals that nurture most of them today. Once animals and plants crept out of the ocean in subsequent evolutions, more support was available to microbes on land and even in the air with reptiles, birds and bugs that served as flying hosts. The super-intelligent species may provide the wings to cultivate microbes on new planets like the moon and Mars in the near future. Perhaps we may have already transplanted microbes into orbiting bodies by accident, such as when some astronauts have lost their lives in space? Would this be seen as a form of contamination or as an extension of evolution into inter-planetary space?

Agevolution

In the history of life on earth, no force of nature and no species prior to man has had such a profound impact on the growth of selected species and the destruction of others as has resulted from agriculture. Our favorite grains and cattle were not naturally selected, but were artificially selected. A different type of evolution is involved here, one that has been described as human manipulated evolution. To see this more clearly, we call this development 'agevolution.' Agevolution is the enhanced evolution of selected species brought about directly by agriculture. It is also the consequential demise of other species that compete with preferred crops, such as weeds and forests, as well as pests that interfere with agriculture, whether by intent or careless destructiveness.

We have shown how moving a crop to a new island can significantly alter evolution. It is clear that the increase or decrease of a population is also an important factor in the survival of a species and how one species may affect others in a competitive environment. Agevolution is distinguished from natural evolution by the increased dynamics of population growth and geographical relocation. So the new *evolution of evolution* should be seen in a comprehensive, four-dimensional perspective including gene quality, cultural changes, population changes and geographic movements.

Four-Dimensional, Comprehensive Model

All four dimensions work together to develop new evolutions. However, the comprehensive view asserts that a new evolution also occurs when only one dimension is changed by itself, whether the change is in population numbers, geographical distribution, culture or gene quality. When a given population of monkeys is moved to a new island, evolution occurs whether or not gene quality is changed or the gene pool changes. When a common rice plant is doubled in production in any part of the world, evolution occurs. In the classic view, we looked only at the one dimension of gene quality. Although we realized the importance of population dynamics and geographical movements on gene quality, we restricted our view of evolution to occur only when and if gene quality were changed.

The comprehensive view of evolution is important today because of the massive impacts of agriculture in population changes and geographical movements. The dimension of cultural change is important in this model because of the dynamic changes in culture today facilitated by modern tools, educational programs, systems of communications and transportation conveniences into all corners of the world. The cultures of the super-intelligent species have tremendous impacts on survival, competition, health, and, of course, agriculture. Agriculture is, after all, a cultural art.

Even if culture were to impact only one species, it would be an important dimension, nonetheless. However, we know that the human cultures indirectly impact the survival of many other species, as well. In addition to agriculture, the cultures of war including weapons of mass destruction have negatively impacted the ecologies of many parts of the world, for example. Scientists have also embarked on experimental cultural exchanges with other intelligent species, as well. For example, crude languages have been taught to some animals to learn more about the animal capacities for language and learning. Some of these animals are known to be a part of our ancestral tree.

The evolution of domesticated animals, such as cats and dogs, is another example of the impact of culture. The human cultures that favor certain behaviors, such as enjoying the intimate relationships with pet animals, ultimately may result in new evolutions of domesticated animals. Additionally, the cultural lessons taught by domesticated animals to their young can be critical to their survival or demise.

The comprehensive, multi-dimensional model of evolution is based on the premise that whether or not gene quality changes occur, the major factors that can influence gene quality by themselves determine evolution. This logic is the extension of the premise that the *possibility* of changes due to probable population isolation is sufficient to define the occurrence of evolution. Going back to the example of Cuculand, we understand that evolution occurred in the classic sense, when the monkeys we moved to this island became the only monkeys on earth due to the demise of monkeys in other parts of the world.

So the act of moving monkeys to a new island was an act of human-manipulated evolution. Had the monkeys somehow swam to this new island on their own, of course, the evolution would still have occurred. However, in this case, they would not have survived had humans not already cultivated the banana trees.

And the evolution occurs when the movement occurs, not when the monkeys are destroyed in other parts of the world. And the new evolution of the banana trees occurred when they were cultivated on Cuculand, as well. This is the multi-dimensional view of evolution.

The value of this model is also clear when we see that reducing the numbers of a population should be seen as evolutionary even before we eliminate the last member of that species. In the classic sense we understand that evolution occurs when a new species is developed or an existing species is destroyed. In the new view we understand that evolution occurs when the population of any species is either increased or decreased. To be truly logical, the numbers may be either significant or incremental. When I snuff out the life of a bug on my back porch, how do I know if this were the last member of a species, or the last parent, or the last queen bee? Likewise, when I nurture the stray cats and dogs in my neighborhood, am I not also contributing to the survival of their species? Is not every meal I feed them evolutionary in the comprehensive view?

The dimensions of population, location and culture may also be seen as *assets* for evolution at an equal par with gene pool diversity and quality. A specific gene pool in one island may be of lesser benefit than the same gene pool in another island. A larger population in a certain ecology may be the critical factor for effective competition with all other factors being constant. A learned culture of singing a mating song in one forest may be compromised by singing the same song in another forest, for example, where another species may prey upon the singer. Greater populations, geographical dissemination and improved cultural development and communications are assets that improve the probability for survival for any species. The reverse is also true. If we humans are intent on manipulating the evolution of other species, we need to determine the best ways of increasing or decreasing the evolutionary assets of each species based on the hopefully thoughtful goals of our machinations.

The comprehensive view is also a *functional* view. It teaches us that what we do with agriculture, industry, education and politics directly evolves new species and destroys many others. Evolution is no longer something that happens with little impact from hominid intervention. We now understand with the multi-dimensional view that evolution today happens rapidly as a direct consequence of agriculture, politics, business, science and also what each of us humans do every day.

Biogenetic Engineering

The direct manipulation of gene quality in scientific laboratories is not a process of evolution, but a revolution of promising improvements and equally frightening risks. Biogenetics doesn't enjoy the natural restrictions of the careful protection of the genetic code afforded by natural selection and artificial selection as practiced on our farms and breeding grounds. In biogenetic engineering, it is possible to change or damage a number of DNA sequences all at the same time. Through testing and laboratory experiments, efforts are made to evaluate all the possible benefits and damages resulting from these changes. New species and breeds do not evolve in the laboratory, but they are *invented* and become the *intellectual property* of the scientists and corporations that participate in these engineering projects.

The paths of evolution and biogenetics intersect when these new inventions are released from the laboratories and are distributed to the external ecologies of the world. Once released, it is agevolution that lets the genie (or gene) out of the bottle and spreads the benefits and potential risks to fertile valleys in various parts of the world. The newly invented species will naturally spread their genes to other areas, whether intended or not. Some ecologists argue that this is a dangerous type of contamination of the natural gene pool that must be carefully contained.

Biogenetics is a reality today that will probably provide great benefits to the world as time progresses, as long as great care is taken to prevent unintended consequences. Potentially, biogenetics may allow agriculture to be more productive using less land and natural resources and consequently causing less damage to the ecology. Biogenetics changes only one dimension of our four-dimensional model of evolution, which is gene quality. The effects of biogenetics on our ecologies will be magnified by agevolution, whether good or bad.

Future Decisions

The human species is capable of growing islands of food in many areas that have not yet been cultivated. In some societies there has been significant progress in birth control. Through modern industries such as organic farming, hydroponics and biogenetics there is the potential to reduce the ecological costs of human consumption needs. Although these new industries may assume competitive relations at times, an intelligent society may be able to take the best features of all these industries, as well as new scientific innovations, and move carefully ahead to improved agricultural productivity with less damage to the ecology. This is the age of agevolution. All types of flora and fauna that survive on our planet in generations to come will be either impacted by, or produced by, agevolution.

The clarification of traditional terms we use in discussing the evolution of species and the definitions of new concepts and terms as we have offered are hopefully useful in helping us deal with human-manipulated evolution in an intelligent way. Whether we find ourselves in the corner of ecology advocates who are intent on protecting as many diverse species as possible, or in the corner of agribusiness, organics or biogenetics, we all need to better understand how our machinations impact our potential for long-term survival on this planet. The competition between species has existed ever since the beginning of life. But never has the advantage of only one species to control the survival of so many others been so

unbalanced as it has since the advent of agriculture. Clearly we cannot live without agriculture. The question is, how long can we live with it?

We may use our inventive minds to understand nature and the process of evolution from different perspectives. We may have invented agriculture and accidentally a new evolution of our species, but we did not invent our own intelligence. Something else did. That something else is still working. That something else was there long before the dinosaurs came and went and it will continue working way beyond the life expectancy of our own super-intelligent species. Let's be reminded of the penguin: "I've got wings, but I can't fly!" Hopefully, the tissue in our skulls will be put to better use, not just to create mechanical wings for ourselves and the bacteria that we host, but also to better understand and safeguard the great legacy we have inherited from nature.

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