The Life Cycle of Evolution*
A Macro-Technological Analysis of Civilization's Progress

William E. Halal**
George Washington University
USA

Abstract

A "macro-technological analysis" is presented for better understanding that rather mysterious process by which life evolved into diverse biological species, produced humankind, founded civilization, and is now creating a knowledge-based, global society entering space. We first examine how each stage of civilization is distinguished by a unique "technical base," and how a "chain of causality" drives this evolutionary process. Then we show that seven waves of technological innovation cause the rise and fall of ever more powerful stages, forming a "Life Cycle of Evolution" roughly comparable to the life cycles of all organisms. I conclude by summarizing what has been learned from this analysis into three principles comprising a general model of evolution. A striking implication of this model is that social progress is today moving beyond knowledge toward "technologies of consciousness" for the same reason previous eras have emerged - out of the sheer necessity to cope with still greater challenges.

Introduction

Although Darwin made it clear that the evolution of species forms follows a well-defined logic, the evolution of *civilization* remains highly controversial because it spans a turbulent, poorly understood past and raises provocative questions about an uncertain future.

For instance, great confusion persists over whether life gets better or worse, and we are not even clear about the nature of progress itself. What exactly is it that progresses, increases, or improves? Physical growth may increase dramatically, such as population and material wealth, but can the same be said about subjective factors, such as quality of life and happiness?

* Portions of this paper previously appeared in World Futures 58: 311-328, 2002

** The author gratefully acknowledges reviews of earlier drafts by Marcelo Foresti de Matheus Cota, Peter and Trudy Johnson-Lenz, Robert Theobald, Israel Dror, Michael Marien, Jerome Glenn, and Stuart Umpleby.

The *cause* of progress reflects a similar dichotomy. Most educated people attribute evolutionary change to physical causes, as in Darwinian evolution. But roughly half of Americans believe evolution results from "intelligent design" by "transcendent powers". (Sawyer 1984)

Such issues persist because we lack a sound theory that can explain how and why civilization evolves. (Marien 1976) What force drives social evolution forward? What purpose is accomplished by its progress? And where are we headed ultimately?

This paper attempts to answer such questions by integrating the literature in evolution, technology, and future studies to analyze what I call the "Life Cycle of evolution" (LCE): that long-term trend spanning the rise of biological species, nomadic humans, Agrarian Civilization, the Industrial Era, a Service Economy, and today's Information Age. Since the focal point is the shift to new modes of technology - agriculture, manufacturing, services, information - the analysis consists of technological forecasting at the "macro" level. Macro-technology transcends specific inventions and industries to focus on how entire technical fields drive social change.

Evolution is enormously complex, of course, encompassing cosmic, biological, and cultural phases, so no perspective can capture its full significance. The LCE seems useful, however, because it reveals how technological change drives a cycle of organic development for the entire planet, although on a scale of such enormous magnitude that almost defies comprehension. We are not used to thinking in such broad terms, but the Earth appears to be evolving through its own life cycle, roughly similar to the life cycle of ordinary organisms. By carefully seeking out meaningful patterns in this grand drama, I think we can identify central principles governing the path that civilization follows and gain a glimpse of where it is leading.

A Macro-Technological Framework

The key to understanding evolution lies in viewing the rapid changes of our time as cultural equivalents of biological evolution. Theodosius Dobzhansky (1962) noted that "Biological and cultural evolution are parts of the same process." Humans today are not very different genetically from their ancient ancestors, yet civilization has progressed enormously since then. The main difference is that today we live in technologically advanced societies.

Table 1 summarizes the seven stages that are believed to comprise the entire LCE using data from well-established sources (Sagan 1977). Biological evolution comprises the first stage, while the remaining six describe cultural forms of evolution. The first six stages are historic fact, while the last – the Existential Era – is a logical but somewhat speculative projection.

The Technological Basis of Society

The organizing principle is that all stages are driven by technological progress. Technology is defined as *the application of knowledge to solve practical problems.* This includes not only the hardware we normally associate with technology, but abstract or "soft" forms of technology as well. For instance, biological evolution has been called "the technology of life." In a technical sense, species evolve when information stored in two sets of DNA molecules is combined sexually to produce better adapted offspring. As we shall also see, even "spiritual methods" are increasingly used to alter awareness and make difficult choices - "technologies of consciousness." (Vaughan 1982) MIT geneticist Eric Lander said after working with the Dalai Lama: "We should regard [Buddism] as a refined technology." (Washington Post 2003)

All stages of social development are distinguished by a unique "technical base" that serves as the primary social determinant, the basic "tools" used to construct any social system. The prevailing technology determines the dominant type of work people do, their social institutions, and central values – in short, the nature of the entire social order. Marshall McLuhan (1964) noted, "Any technology creates a totally new human environment," and Arthur C. Clarke (1973) summed it up as simply, "Tools invented man."

Of course, technology is basically knowl-

Table 1

The Macro-Technological Framework

STAGE OF EVOLUTION	1 BIOLOGICAL ERA	2 NOMADIC ERA	3 AGRARIAN ERA	4 INDUSTRIAL ERA	5 SERVICE ERA	6 KNOWLEDGE ERA	7 EXISTENTIAL ERA
DOMINANT TECHNOLOGY	Genetics	Primitive Tools	Farming	Physical Technology	Social Technology	Information Technology	Technologies of Consciousness
BEGINNING OF ERA	Creation of Life 4 Billion BC	Development Of Humans 3 Million BC	Agrarian Revolution 7000 BC	Industrial Revolution 1850 AD	Post-Industrial Revolution 1950 AD	Information Revolution 2000 AD	Spiritual Revolution 2020 AD +/- 10 yrs
HISTORIC OUTCOME	Species	Clans & Tribes	Civilization	Mass Production	Large Organizations	Information Networks	Global Order
HIGHER CHALLENGE	Survival	Food Scarcity	Poverty	Social Disorder	Complexity	Globalization	???

edge derived from scientific findings, creative ideas, and other cultural innovations. But social conditions do not change until this knowledge is applied widely to alter the social order. In short, technology serves as the fulcrum on which cultural forces leverage change throughout the social system. Physicist Freeman Dyson said "Technology is a gift from God. After the gift of life, it is perhaps the greatest of God's gifts."

The Chain-of-Causality

Figure 1 organizes this data into a diagram illustrating the "chain of causality" that is believed to drive this entire evolutionary cycle. As the legend illustrates, this process follows the logic of the Hegelian dialectic. Each stage of evolution produces a historically unique social order, or status quo, as its logical outcome (the "thesis"). But the new social order intrinsically produces a higher-order challenge that cannot be resolved by prevailing capabilities. This challenge persists until a higher-order technology (the "catalyst") is developed to resolve it, producing a new status-quo (the "synthesis"), which repeats this process again.

The most basic example occurred when the evolution of species (the thesis) created a struggle for survival as the dominant challenge (the antithesis). The invention of primitive tools (the catalyst) resolved this challenge as tool-wielding apes gained an edge over other creatures, eventually producing humans whose larger brains granted a superior capacity for survival (the synthesis). Figure 1 outlines how this dialectic process seems to have produced civilized nations, then a mass production society, and so on, forcing progress toward higher levels of adaptation.

Why This Framework is Unique

It should be noted that this conceptual framework shares common features of other macrohistorical frameworks. Spencer, Toynbee, Sardar, and other analysts all used life cycles, waves of innovation, and dialectic processes in their theories. (Galtung and Inayatullah 1977) This framework differs in several ways. First, where other macrohistorians focused on the life cycles of *societies* (e.g. the Romans), this describes the life cycle of *the planet*.

This perspective also differs by pinpointing the cause of historic change as emanating from underlying macro-technological forces. Because of this sharp technological focus, we can then ground the framework in rigorous, precise terms. For instance, the analysis that follows is based on the historic data in Table 1 and its conclusions can be tested empirically.

This view even represents a unique definition of the role of spirituality that dominates the theories of macrohistorians. Whereas others regard spirit as a distant aspiration, the LCE show how it arises naturally out of the evolutionary process. Spirituality is more precisely understood - not only as a higher state of being - but as the ultimate source of power beyond a knowledge society, an emerging technology of consciousness for creating meaning and action itself.

Shifting Technological Foundations

This perspective illustrates the fundamental unity that underlies the evolutionary process. All forms of evolution draw forth superior technological forms through small tentative advances, leaving the best adapted to survive because they are most functional. This is true for biological evolution – in which the DNA code represents a superior pattern for perpetuating the species – as well as the invention of better machines, social structures, information systems, spiritual practices – which represent superior tools for social progress. These various types of evolution all stem from the same basic process of adaptation as life experiments to improve itself through competition for the survival of the most fit; the only difference is that in cultural evolution the struggle takes place among competing technological artifacts rather than biological organisms.

From this macro-technological perspective, it becomes clear that the same evolutionary process that required billions of years to create life has accelerated during the past few decades when science and technology began to advance dramatically. And today the Information Revolution is disseminating a wealth of new

knowledge around the globe - the very heart of all innovation - driving civilization into uncharted territory.

Civilization Advances on Waves of Innovation

Obviously, evolution transitions through these stages gradually rather than in abrupt steps. Figure 1 shows how the stages in Table 1 form waves of technological progress, highlighting the crossover points from an older ear to a new era. A more advanced technology rises to challenge the status quo, the old social order then yields to a new social order, the new era flourishes for a while, and it finally recedes to lay a foundation for the next wave to repeat this process again. Thus evolution advances along the crest of waves of technological innovation. Here's a quick two-minute summary of this journey along stages of development.

A Quick Journey Along Stages of Social Development

Civilization began when the invention of farming permitted the stable communities that formed Agrarian Societies. Manufacturing technology introduced the Industrial Age and automated farming, reaching a crossover point about 1850 when factories replaced farms as the primary employer. The next crossover point occurred at 1950 when the automation of factories moved the bulk of the labor force to white collar work. (Bell 1973)

The Service Era then emerged using "social technology." Social forms of technology are not widely understood, but they can be best grasped as applications of social science - just as physical technology is applied physical science. (Conger 1973) For instance, the study of management attracts the largest college enrollments today because of the need to draw on psychology, sociology, economics, and other social sciences to manage a growing infrastructure of corporations, governments, and other large social institutions. (Ginzberg & Vojta 1981)

Just as in previous stages, service economies are being automated by information technology. The computer is eliminating clerical work (automatic bank tellers, word processing), sales (online marketing), middle management (the virtual organization), and other routine service tasks. The crossover point to the Knowledge Era occurred about 2000 AD when a majority of the workforce began using intelligent information systems in homes and offices.

Beyond the Knowledge Era, we may witness a "Spiritual Revolution" powered by "technologies of consciousness" to produce an "Existential Age." This is speculative, obviously, but it follows logically from the order of increasing abstraction as civilization progresses from farming, to industry, to social relations, to knowledge, and finally to mental and spiritual concerns. Toynbee (1954) observed an historic trend toward the "etherealization of life." Let's take a moment to clear up the normal confusion over "spirit."

What Really is Spirit?

Spirituality is often dismissed as ignorance or fantasy, but that's because its very nature transcends rational logic. Sprit is not simply the supernatural but a higher state of mind *beyond knowledge*. Webster's Dictionary defines spirit as "Will, consciousness, frame of mind, mood. As in high spirits." This prosaic spirituality is simply that sense of awareness we experience while passing through various states of consciousness every day - the altered mood produced by meditation and prayer, alcohol and drugs, social relationships, and many other factors that have been shown to affect the mind. (Smith 1975; Ferguson 1980; Panati 1980)

An impressive body of evidence is accumulating to demonstrate the effects of human spirit. Medical research shows the strong impact of attitudes on health, and spiritual practices are entering business, sports, and politics. (Halal 2004a) Here's how a woman executive described her spiritual approach to business: "It makes me feel plugged into the fundamental power of the universe." (BusinessWeek 1999) These are not usually considered "technologies," but they fit the definition used here: *Technologies of consciousness are used to shape emotions, mood, understanding, and other facets of awareness to cope with life's challenges.*

Thus, spirit is more than bliss or goodness but the source of existential acts. As philosophers have noted, life is lived moment-by-moment as crucial decisions fix the course of events. And because spirit sets our perception of reality itself, all behavior flows out of this stream of consciousness that people inhabit. Many claim the biggest problems today - crime, violence, social conflict, etc. – stem from the lack of worthy beliefs, emotional maturity, social support, and other failures of spirit now reaching crisis levels, as we shall see in the next section.

The crux of the matter is that the world seems to be facing higher-order challenges that are not ordinary, rational problems. To cite the most notorious cases, the endless conflicts between Palestinians and Israelis, protection of the environment, and North-South gaps in wealth can only be understood ultimately as intensely moral and spiritual dilemmas. One of the most powerful but frightening displays of spirit is global terrorism. Like it or not, the fact is that the driving force behind radical Islam is spiritual, which is why it poses such a formidable threat.

Perhaps the most shocking manifestation if spirit is the "second sexual revolution" that is well underway. Viagra sales are skyrocketing, porn remains the biggest industry on the Internet, and rock idols like Madonna and Britney glorify sex. Freud would be amazed. Though we may abuse sexuality in endless ways, modern people seem determined to savor this fundamental force of nature because this act of creation is one of life's most intensely spiritual experiences, now practiced openly and celebrated as a central value.

These examples remind us that unleashing spirituality can be frightening and disturbing. The biggest problem, however, is ignorance about this mysterious phenomena. Our understanding of spirit is as limited today as our view of IT was at the dawn of the Information Revolution. In 1950, who would have thought we would spend a good part of our lives staring into PC monitors, working the Internet, using cell phones - an entire society focused on information! The idea would have seemed as shocking and mysterious as the concept of spirit today. Arthur C. Clarke (1973) noted that future technologies always appear to be magical.

The spiritual domain is so poorly defined that one can only speculate about it to a large extent. At the individual level, there is a swelling interest in cultural heritage, religious beliefs, mind-body practices like meditation and Yoga, emotionally balanced lifestyles, self-help programs, authentic social relations, and drugs (like Prozac) to alleviate mood disorders. At organizational and national levels, we increasingly see serious attempts to define worthy missions, collaboration among disparate groups, conflict resolution, social ceremonies, and even confessions of national sins.

The list of possibilities is endless, but similar practices are likely to be used in the years ahead out of the growing need to heighten understanding, clarify the mind, build social cohesion, and summon the moral will to make tough choices. The Spiritual Revolution will also be fueled by a surging hunger for meaning and purpose, of course. But the hard logic of evolution suggests it will mainly be driven by the need to gain control over a more challenging world.

The Possibility of Higher Powers

A few caveats are needed to clarify the limitations of this framework. These trends are restricted to industrial nations while much of the world remains at the agrarian level. And higher technologies have always been used, so in a sense nothing is really new. Ancient societies employed social technology (governments, armies), IT (hieroglyphics) and spiritual technology (religious rituals). The stages described here occur when some function develops into a formal, rational, powerful system. It then becomes the principal task for the majority of the work force instead of remaining the concern of a small elite. In short, a higher function matures.

What is clear, however, is that civilization's progress moves up a hierarchical order toward "non-physical" or "metaphysical" technologies offering greater power. Cooperation can harness the energy within a social system, knowl-

edge is the source of innovation, and spirit is believed to motivate all behavior. (Halal 1998) The power of spirit was noted forcefully when politicians attended a rally held by Reverend Billy Graham: "We think of ourselves as being in the business of trying to motivate people. But that! That was power." (Russakoff 1981)

To carry this line of thought further, many scholars think human spirit is connected to some "universal" form of spiritual energy. J.K. Rowling, the creative author of the Harry Potter books, described the source of her inspiration this way: "It feels as if someone zapped the ideas into my head." So we come to the fascinating possibility that this entire evolutionary process may be powered by some poorly understood higher power that flows from the top of the technological hierarchy, where it then cascades like a waterfall (Troncale 1978) down through the lower levels in the form of information, then social behavior, and finally as physical artifacts.

The Organic Cycle of Planetary Life

The long-term trend formed by the data in Table 1 can also be plotted, as in Figure 2, to illustrate the complete LCE. The time horizon is portrayed in logarithmic scales to compress these enormous time differences into a comprehensible figure.[1] On an ordinary scale, the curve would simply run flat and then turn up at a right angle. This shows that the entire rise of civilization takes place in an infinitesimally short period by cosmic standards, as though the planet suddenly came alive in a flash of creative energy. (Jantsch 1975, 1981)

The Earth as a Growing Organism

Spread out on a logarithmic scale, however, we see a well-ordered progression of developmental stages making up the life cycle of the planet. This is the same S-curve that characterizes the growth cycle of all life forms: a culture of bacteria, a human being, or the life of a planet. In other words, the entire planet, including all life forms on it, appears to comprise a single living, growing organism in its own right - Gaia. (Lovelock 1988)

This organic quality is also seen in the way these stages accumulate as social strata to produce a complex system in which all levels interact. As noted in the chain of causality, lower stages provide the resources that make later stages possible - a *"push" imperative of upward causation.* For instance, complex species like apes had to evolve before humans could emerge, which then permitted farming, etc. Conversely, higher stages offer more powerful technical capabilities able to overcome the limitations of preceding stages - a *"pull" imperative of downward causation.* Farming was automated by industrialization, which became more productive using large organizations, which are transformed by IT. Thus, all levels of evolution grow continuously as the entire structure is pushed from the bottom and pulled from the top.

The LCE is revealing because it helps identify three inflection points: the "Take-Off Point" when rapid growth begins, the "Pivot Point" marking the shift from growth to stability, and the "Saturation Point" of planetary maturity. The following discussion describes the path of this extremely long cycle, focusing especially on the significance of these key points. Let's take another two-minute trip, this time through the life cycle of the planet.

A Quick Trip Through the LCE

The LCE began about 10 billion years ago when cosmic evolution formed the Earth following the Big Bang. The planet then slumbered through a long gestation period as geological evolution shifted continental plates and biological evolution produced myriad species. Humans appeared during the last .03 percent of this time.

Then a unique event occurred. Figure 2 shows that the transition from BC to AD coincides roughly with the Take-Off Point when the LCE begins rising steeply upward to commence its great ascent through higher levels of development. This may clarify our understanding of those crucial few hundred years that mark the beginning of modern time. Moses, Christ, Mohammed, Buddha, and the other great religious leaders apparently served the historic pur-

Figure 1 The Evolutionary Chain of Causality

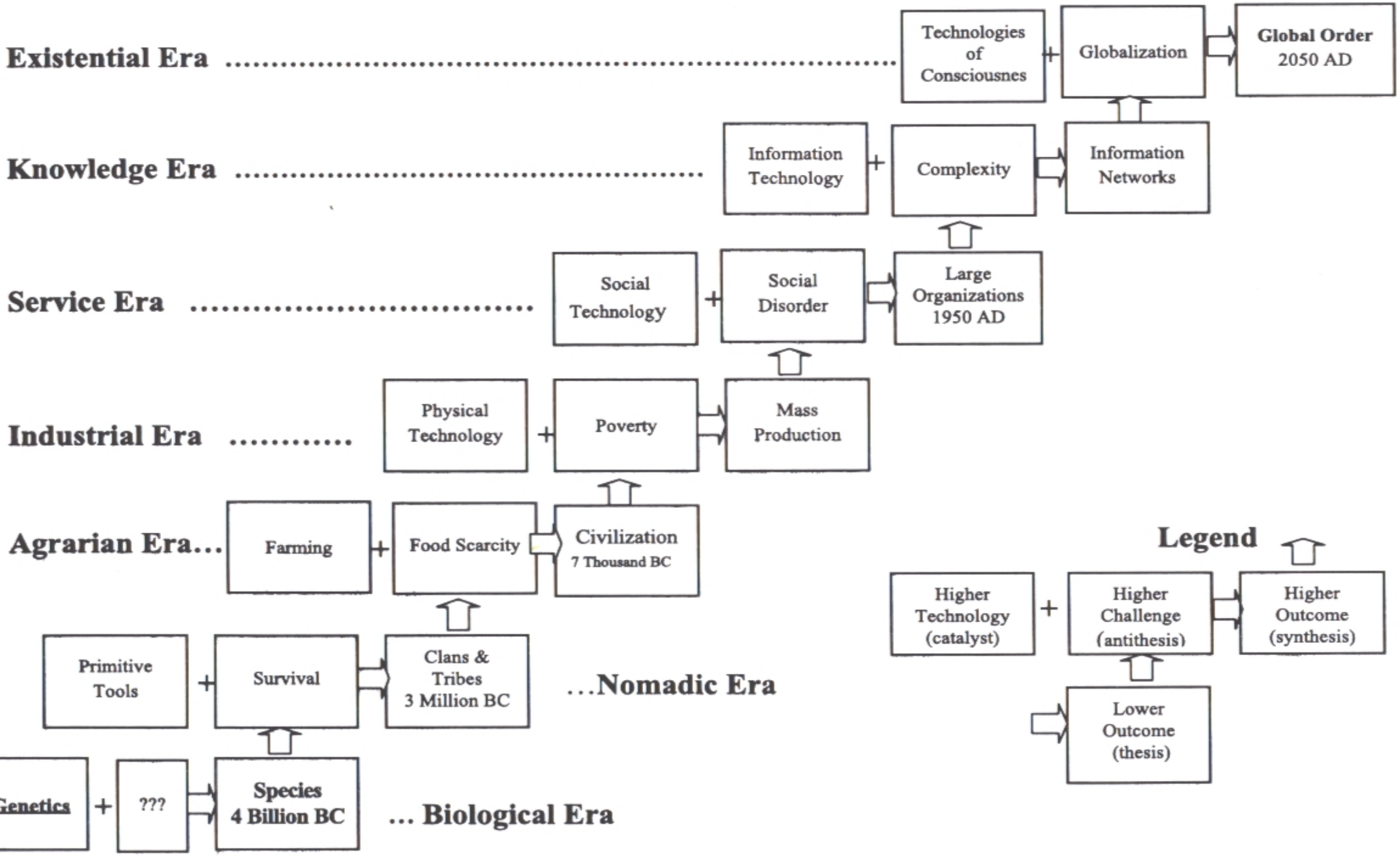
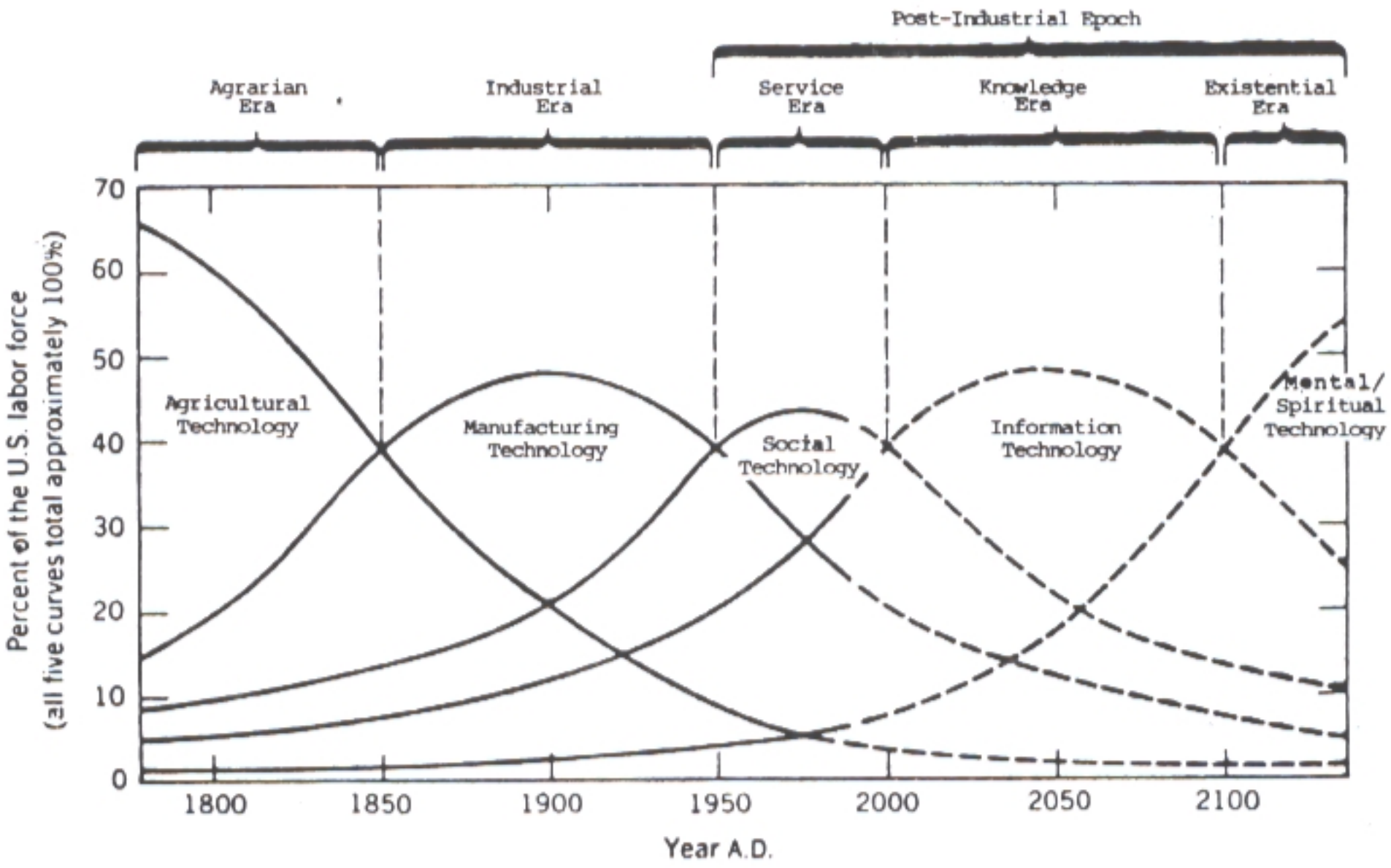


Figure 2 Waves of Technological Evolution



pose of harnessing the spiritual energy flowing from the top of the hierarchy of evolution, initiating the rise of human spirit that eventually produced modern civilization.

Since then progress has accelerated rapidly by almost any measure of change: world population, the speed of travel, energy usage, and countless other indicators all bend sharply upward. This pattern of accelerating growth becomes apparent by noting that the times between stages are consistently shorter by orders of magnitude: 4 BILLION years of biological evolution were required to develop humankind; 3 MILLION years passed before the onset of civilization; 9 THOUSAND years later industrialization occurred; 1 HUNDRED years after that the Service Era began; and 5 DECADES were needed to reach a Knowledge Age.

This broader perspective has emerged only recently as information technology began to clarify our view of the evolutionary pathway. Now the Earth seems alive, growing like a huge organism through a life cycle of development that may occur on other planets throughout the universe. Marshall McLuhan (1972) described this new awareness using a vivid analogy:

Today, it is the instant speed of electric information that, for the first time, permits easy recognition of the patterns and contours of development. The entire world, past and present, now reveals itself to us like a growing plant in an enormously accelerated movie.

The Crisis of Global Maturity

The acceleration of evolution reaches its peak at the Pivot Point (Capra 1972) This point seems to have been passed in 1975 to mark that unique period when physical growth slows to approach equilibrium. Note that although *growth starts decreasing* at this point, *the rate of growth is greatest* at the same time.[2] The result is that civilization is being virtually rocketed from an endlessly long, quiescent past into a far more sophisticated future.

This critical inflection also seems to reverse polarity throughout the system – from growth to stability, conflict to cooperation, physical to non-physical, and so on – which is why the past few decades seem so hectic and rife with change. The controversial issues that have arisen to challenge the old industrial order - environmental constraints, population growth, globalization - comprise critical shifts that deflect the LCE in this new direction.

The world has always faced massive prob-

lems, of course, but this unusual constellation of interrelated world crises has received much attention and there is general agreement that it requires higher-order global concepts, systems, and attitudes. (Peccei 1977) Herman Kahn and John Phelps (1979) noted that the rate of population growth peaked during the 1970s, and Harold Linstone (1977) concluded in a survey of the literature: "Both optimists and pessimists ... agree that the world is at a transition."

A few salient facts illustrate the critical nature of this "crisis of global maturity." World population should stabilize at about 9 billion people in 3-4 decades, and most of these people will come from poor nations eager for the material comforts now enjoyed by 1-2 billion prosperous people. Thus, the number of people living at industrial levels is likely to leap from 1-2 billion to almost 9 billion, increasing the stress on the global system by a factor of 5-6.

This means that the level of industrial production, competition for world markets, change and innovation, demand for scarce resources, material consumption, and environmental degradation will all grow at least 5-fold over the next three-four decades. The industrialization of China alone should double these crises, and India will double them again. The inescapable conclusion is that the world faces a high-order challenge of creating a global system that can manage this leap in growth on a planet already suffering from congestion, conflict, scarcity, and environmental stress. Robert Shapiro, CEO of Monsanto, sees it this way:

> No demographer questions [the *forecast*] *that the population will double around 2030.*
>
> *Without radical change, the kind of world implied by those numbers is unthinkable. The whole system has to change. (Magretta 1997)*

The Passage to a Mature Global Order

The significance of this event can be grasped by comparing the LCE to a human life cycle. People pass through similar stages, and today the world seems to be working out roughly the same crisis that tests every youth. The typical adolescent has reached almost complete physical growth but has not yet developed the social, intellectual, and moral skills needed to function in a complex world. This is almost precisely the state of modern nations today. These societies possess physical technologies that can destroy all life, but they have not learned to control this power with collaborative institutions, useful information systems, and shared values.

The LCE serves a useful analogy, therefore, because it is roughly similar to the challenges people wrestle with in their daily lives. The main difference is that the planet's life span covers eons of time, progress is imperceptibly slow, the system is infinitely larger and more complex, and the stakes are vastly higher. From this view, the crisis of global maturity represents a rite of passage for humankind, just as the crisis of puberty ushers the child into adulthood.

Successful passage through the crisis of maturity is not inevitable, of course, but it is most likely because this is a natural process that far exceeds human powers. We've seen that the planet is a great organism moving through its life cycle, so social crises are mere blips on this grand process of global development. History shows that civilization has evolved steadily from tribes, to cities, to nation states, to superpowers – leading toward the next logical step of a unified world order. Let's extend this model to forecast its implications.

The Knowledge Revolution is now the most powerful force on Earth, accelerating innovation, restructuring institutions, and unifying humanity into some form of "global intelligence." (Teilhard de Chardin 1965; Russell 1983) In two or three decades when this "central nervous system for the planet" is completed, the Information Age should mature and fade into the past as previous eras have done. (Halal 2004b) We are then likely to move beyond knowledge for the same reason all other technologies first appeared - because technologies of consciousness will be necessary to overcome the crisis of maturity.

I realize this seems idealistic, but remember that dramatic shifts in awareness occur at each crossover point. In the Industrial Age, who would have believed that Communism would

collapse? That the Internet would permeate life? That business would focus on managing knowledge? In a similar way, the Knowledge Age may yield to an Existential Age about 2020 +/- 10 years as globalization approaches crisis levels. (Halal 2001)

Completing this passage should then allow the Earth to approach equilibrium at roughly 2050 AD +/-20 years. At this Saturation Point, the population stabilizes, the world is unified into a coherent global order, and the planet is managed as a steady-state system of dynamic equilibrium that permits internal change. Although *physical* growth would culminate at this point, *metaphysical* progress may grow indefinitely.

A previous study integrated global supertrends into a scenario summing up what the world should look like about 2050. (Halal 1993) This "Standard Scenario of Global Maturity" shown in Box 1 can be thought of as the "standard" or "most likely" future from which others may deviate, some being less desirable while others are more desirable. Which variations will occur is hard to say, but they should all share these same general features of a mature world order.

Box 1
The Standard Scenario of Global Maturity

In 2050 AD, the world achieved a mature state of development marked by a few distinctive features. Global population peaked at 9 billion people who mainly live in knowledge societies, although some remain at industrial or agrarian stages. Powerful information systems are used to manage the complexity of this global civilization and to advance the pursuit of knowledge, which produces continual technological breakthroughs. The resulting five-fold leap of industrialization forced all techno-economic systems to be made ecologically benign, yet minor environmental crashes still occur. Society works hard to curb the destructive tendencies of people with limited success, so occasional wars, crime, and other forms of violence persist. Most nations are part of a functioning global community, but a decentralized form of governance also nourishes wide diversity. These differences are held together by an international culture that agrees on common standards of behavior and general set of spiritual values that unify the world into a functioning whole. Now that the planet contains almost 9 billion educated people organized around global IT networks that allow close collaboration, this vast intellectual force is being harnessed to discover the deeper laws of physics that will allow human life to expand throughout the universe.

Source: W. E. Halal. "World 2000." *Futures* (1993) 25: 5-21.

Beyond the LCE

Global unification may then introduce a final phase beyond the LCE – colonization of deep space. The challenge of sending humans out of our solar system is so enormous that is inconceivable with present scientific capabilities. The nearest star system is four light years away, and since today's technology limits travel to 10 percent of light speed, a one-way trip would take 40 years. That's the *nearest* star. Deep space travel requires a fundamental breakthrough in physics, therefore, collectively undertaken by a unified world of 9 billion educated people. Astronaut Edgar Mitchell believes the Space Age requires a unified planet:

> *The exploration of deep space, of other planets and other solar systems, is such a tremendously expensive high-technology undertaking that a nation by itself cannot do it alone... It's got to be a global effort. (Fowler 1985)*

Using our analogy of the Earth as an organism, it could be said that this exodus will represent offspring of the planet sent out to perpetuate civilization throughout space, much as parents send their children into the world. And because space communities will possess the Earth's heritage of knowledge, just as a child inherits the legacy of its family, space exploration may initiate a new cycle of evolution at an even higher level, as shown in Figure 2. This may be the major step evolution has been building toward – launching humans throughout the universe.

Power, Progress, and Purpose

Now, what are we to make of this magnificent evolutionary unfolding, and how does it resolve the questions posed at the beginning of this paper? What power causes evolution to move so precisely through these seven stages? How can we define the nature of evolutionary progress to reveal what increases along the LCE? And what final purpose does evolution serve, if any?

It is impossible to answer such daunting questions satisfactorily, of course, but the observations outlined in the preceding sections permit tentative conclusions.

What Energizes the Process of Evolution?

The underlying power driving evolution appears to be the same life force that carries other organisms through their cycle of development. Just as microorganisms, animals, and humans develop through well-defined stages of growth and decay, similar forces appear to operate at the level of the planet. Our limited perspective obscures the fact that all life forms on Earth and their physical environment together constitute a single great organism. Let's review a quick summary of the various points made earlier illustrating this organic nature of evolution.

As noted before, the twin imperatives of upward and downward causation push resources from the bottom and pull power from the top, illustrating that the planet is an interacting, organic system, as the perspective of Gaia would expect. This organic hypothesis is also supported by the characteristic S-curve of the LCE, the orderly way stages move from the primitive (survival and farming) to the sophisticated (knowledge and spirituality), the expansion of social systems to encompass the globe, and the way all life forms are intimately connected in ecosystems. This conclusion can be stated as the first principle of evolution:

Principle 1
Major technological advances form developmental stages in the life cycle of the Planet, similar to the life cycles of all organisms.

We have only one planet to examine as yet, but despite wide cultural diversity around the globe, civilization everywhere has traced roughly the same path marked by these seven stages. Many scientists are pursuing the search for extraterrestrial life because it is estimated that living planets must number in the billions. When and if life is discovered elsewhere, it will be interesting to see if similar stages have been followed there as well.

Biological species are part of this organic process of planetary development, but they constitute the minutia of evolution, rather like the countless subsystems that constitute the body of any larger organism. Trying to understand evolution by focusing on individual species is akin to studying human behavior by focusing on the cells of the body.

What Constitutes Evolutionary Progress?

We also saw that progress struggles up a chain-of-causality that produces both great costs as well as great gains. Modern life is so vastly improved over the harsh conditions of ancient societies that average people in industrialized nations enjoy comforts that would have been considered opulent in then past. But a great price has been paid in congestion, pollution, bureaucracy, and other problems that did not exist before. And although the Information Age may alleviate these ills, it in turn produces information overload, exploding complexity, globalization, and other new disorders. Evolution seems to bring mixed blessings, then, because each stage solves the challenges of the preceding era – but new challenges are introduced.

This continual trading of old problems for new problems illustrates that evolution is far more complex than simply accumulating benefits. Change is forced on the system when its limits present no choice but to move forward, yet the next stage poses tougher challenges requiring still more powerful adaptations. Thus, social progress is neither "good" nor "bad" in the ordinary meaning of these terms. Progress magnifies the existential dilemmas of life.

A good example is the power to control genetics now being conferred by biotechnolo-

gy. Modern medicine is making it possible to replace organs, eliminate genetic defects, and extend life – posing agonizing decisions that determine who dies and who lives. As advanced technologies increase human capabilities, therefore, they also produce greater dangers endemic to a more difficult society. The result is that civilization must continually struggle forward to contain the turbulence produced by its own progress. Hence, our second principle:

Principle 2
Progress is driven inexorably forward because each stage of evolution presents more difficult challenges that require more powerful technologies.

Even the possibility of a Spiritual Revolution hardly means that life will become Utopian. Religious causes have always usurped the power of faith for war, persecution, and a great deal of other perverse behavior. It may even be that the future will pit more intense moral differences against one another, creating biblical-like battles between good and evil. In short, spirit is not goodness but a higher state of being that can take almost any form.

I conclude that life at advanced stages is more *intense*. It requires the careful use of more sophisticated capabilities, involving greater complexity, to choose among a wider range of options, entailing more dangerous risks, to carry out grave new responsibilities, with more profound consequences. Evolution may improve our material well being and it may even bring happiness. But the most salient feature of progress is that the continual development of ever greater powers intrinsically produces greater threats that make life more intensely challenging.

Can We Discern the Final Purpose of Evolution?

The model of evolution described above leads to our final conclusion: civilization inexorably moves toward the transcendent. Life has steadily progressed from working the soil, to manufacturing goods, to organizing complex social systems, and now mastering the use of knowledge. George Glider's (1989) incisive analysis of the Information Revolution concluded: "The central event of the 20th century is the overthrow of matter."

As we've also shown, the Information Age will fade into the past about 2020 or so, while an even more abstract Existential Age may be rising to address challenges beyond knowledge. One of the most striking patterns in the above trends is the increasing range of power, choice, emotion, awareness, wisdom, meaning, and other facets of human spirit. (Harman 1988)

On the basis of evidence and logic, then, evolution seems to cause a continual growth of human spirit, which can probably be demonstrated empirically. Who could deny that there is far more spirit in the world today, and certainly before life existed at all? Moreover, this growth of spirit seems to arise naturally out of the process of life itself. Just as a tree bears fruit, so life produces spirit. The only serious question remaining is, where does the power that energizes this human spirit come from? *We may be doing the pushing, in short, but who is doing the pulling?*

If we examine these patterns broadly, it seems that the LCE itself suggests the existence of some higher power. Wherever there is growth in some precise direction, there must be some form of intelligence drawing it on. For instance, the very existence of human consciousness represents nothing less than a great miracle. Billions of years ago the planet was simply a mass of hot rock. Then, after the endlessly long period of biological creation, humans appeared almost out of nowhere, and now billions of intelligent people ponder the meaning of this mystery.

Speaking as a scholar, I find it very hard to attribute this great drama to physical causes alone. It seems far more reasonable that this magnificent act of creation is inspired by some higher intelligence, just as human creations are inspired by *our* higher intelligence. Whatever this higher form of energy happens to be, it seems to draw us toward it, in roughly the same way that a flower grows toward light. Our final principle can then be tentatively stated as:

Principle 3
Evolutionary stages become increasingly metaphysical, suggesting that life is drawn toward some transcendent purpose.

If this is true, scientific views of evolution may then be seen as compatible with religious beliefs. Science may describe the *what*: the mechanisms by which life evolves. But spirituality may help us see the *why*: the likely possibility that all life is powered by some form of spiritual energy. Even now, the evidence of spiritual phenomena cited earlier is causing many scientists to propose more general theories that could revolutionize our view of reality to include spiritual matters. (Sperry 1986; Sheldrake 1981) A poll of 1500 Americans found that 70 percent see no conflict between evolution and divine creation. David Chalmers, a philosopher at the University of Arizona, thinks "we are likely to discover that consciousness is a fundamental property of the universe, like space, time, and gravity." (Russell 2000)

This fundamental nature of spirit may signal the meaning of evolution. Life evolves toward the transcendent because the source of this spiritual power appears to be both the cause and the purpose of evolution. The existential dilemmas that must be surmounted may be heroically painful, but they appear to be an intrinsic part of this process because they transform us into fitting vessels of that energy. The German philosopher Nietzsche put it well: "The universe is a machine for making Gods." The purpose of evolution may possibly be defined, therefore, as a difficult but necessary path for the purification of humankind as it approaches the transcendent.

Correspondence

halal@gwu.edu

Notes

1. The horizontal dimension is a 10 cycle logarithmic scale in order to display the time differences between various stages of evolution. Because log scales cannot have a zero point, all times must be expressed along a single direction; the scale was therefore defined as "Years Before 2,500 Years AD" and because this reference point spreads the present stages of evolution out conveniently. The vertical dimension is an ordinal scale corresponding with the rank order of the stages shown in Table 1.
   It should be noted that, although the LCE appears to form a smooth, gradually changing cycle, it actually represents the "envelope" composed of seven smaller S curves corresponding with these 7 stages. As the punctuated theory of evolution points out, the LCE is punctuated by the abrupt growth spurts of each stage of evolution, and these epochs are linked together in a series of growth cycles that form the LCE.
2. In technical terms, the first derivative of evolution – speed – reaches its maximum precisely when the second derivative - acceleration – reverses from an increasing to a decreasing rate of change.

References

Bell, D. 1973. *The Coming of Post-Industrial Society.* New York: Basic.

BusinessWeek. 1999. *Religion in the Workplace.* November 1.

Capra, F. 1982. *The Turning Point.* New York: Simon and Shuster.

Clarke, A. C. 1973. *Profiles of the Future.* New York: Harper & Row.

Collins, W. 1979. *Webster's Twentieth Century Dictionary.*

Conger, S. 1973. Social Inventions. *The Futurist:* August.

Dobzhansky, T. 1962. *Mankind Evolving.* New Haven, CT: Yale University Press.

Dyson, F. J. 1988. "Will Man Survive in the Cosmos?" *The Washington Post.* April 3.

Ferguson, M. 1980. *The Aquarian Conspiracy.* Los Angeles: J. P. Tarcher.

Fowler, L. 1985. "From Outer Space to Inner Odyssey." *New Age Journal.*

Galtung, J. and S. Inayatullah. 1977. *Macrohistory and Macrohistorians.* Wesport: Praeger.

Gilder, G. 1989. *Microcosm.* New York: Simon & Shuster.

Ginzberg, E. and G. Vojta. 1981. "The Service Sector of the U.S. Economy." *Scientific American.*

Halal, W. E. 1993. "World 2000." *Futures* 25: 5-

21.
_____.1998. *The Infinite Resource.* San Francisco: Jossey-Bass.
_____.2004a. *Beyond Knowledge: The Coming Spiritual Revolution.* In Progress
_____.2004b. www.TechCast.org.
Harman, W. 1988. *Global Mind Change.* Indianapolis, IN: Knowledge Systems.
Magretta, J. 1997. "An Interview with Monsanto's CEO." *Harvard Business Review* (Jan-Feb) 75(1): 79-88.
Jantsch, E. 1975. *Design for Evolution.* New York: Braziller.
_____. 1981. *The Evolutionary Vision.* Boulder, Colorado: Westview Press.
Kahn, H. and J. Phelps. 1977. "A Chartbook for the World Economy." *The Futurist.*
Linstone, H. and C. Simmonds. 1977. *Futures Research.* Reading. MA: Addison-Wesley.
Lovelock, J. 1988. *The Ages of Gaia: A Biography of Our Living Planet.* New York: W. W. Norton.
Marien, M. 1976. *Societal Directions and Alternatives.* Lafayette, NY: Information for Policy Design. Pp. 391-3, documents 63 examples of such evolutionary models.
McLuhan, M. 1964. *Understanding Media.* New York: McGraw-Hill. Introduction.
_____. 1972. "Automation: Learning a Living." in Alvin Toffler (ed.), *The Futurists.* New York: Random House. 66.
Panati, C. 1980. *Breakthroughs.* Boston: Houghton-Mifflin.
Peccei, A. 1977. *The Human Quality.* Oxford: Pergamon.
Russakoff, D. 1981. Crusading in Baltimore. *The Washington Post.* June 12.
Russell, P. 1983. *The Global Brain.* Los Angeles: J.P. Tarcher.
_____. 2000. *From Science to God.* Suasalito, Ca: Peter Russell.
Sagan, C. 1977. *The Dragons of Eden.* New York: Ballantine.
Sawyer, K. 1984. "Christian Right Takes Center Stage." *The Washington Post.* December 25.
Sheldrake, R. 1981. *A New Science of Life.* Frederick Muller.
Smith, A. 1975. *Powers of Mind.* New York: Random House.
Sperry, R. 1986. "The New Mentalist Paradigm." *Perspectives in Biology and Medicine.*
Teilhard de Chardin, P. 1965. *The Phenomenon of Man.* Fontana.
Toynbee, A. 1954 *A Study of History.* Oxford: Oxford University Press.
Troncale, L. 1978. "Origins of Hierarchical Levels." *Proceedings of the 220 Annual Meeting of the Society for General Systems Research.*
Vaughan, A. 1982. "Intuition, Precognition, and the Art of Prediction." *The Futurist* June.
_____. 1997. "Growth Through Global Sustainability." *Harvard Business Review.* January-February.
Washington Post. 2003. A Meeting of Minds. (September 21)

Figure 3
The Life Cycle of Evolution