

THE CHILD AND NATURE: RE-INTEGRATING THE WHOLE

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Abstract

The topic of this paper is the changing relationship between the child and nature through time. It begins with a brief history of humankind's relationship with nature from prehistoric times to the present, looking at Gang's theory of four ages: the Age of Humanity in Nature, the Age of Humanity with Nature, the Age of Humanity over Nature, and the Age of Humanity through Nature. Berry and Louv's perspectives on the historic frontiers of North America are included as well. It also defines and describes Gardner's term "naturalist intelligence" and E.O. Wilson's "biophilia." Research on nature's influence on human health and intelligence as well as nature-deficit disorder is reviewed in detail. Berry's vision for an Ecozoic Era is examined and considered as an inspiration to address the growing schism between humankind and nature and the resulting ecological crises. Briggs and Peat's *The Seven Life Lessons of Chaos* and Varela's theory of *autopoiesis* form a platform for Ecozoic instruction. A lesson for young children is included and observed from a neurophenomenological perspective. Finally, suggestions are made for educating to re-integrate humankind with nature and the Universe as a whole.

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Chapter 1: Introduction

Over the millennia of humankind's history, the relationship between the child and nature has undergone many changes. Humankind first entered life on the planet in an environment rich with diverse life forms, many of which were far more powerful than humans. The human child, by necessity, learned what sustained life and what did not. "Nature intelligence" was key to surviving in a harsh world. Whereas our primitive ancestors relied upon a keen awareness of natural surroundings, in modern times survival no longer depends upon following the herds or being wary of predatory beasts.

Change seems to be an inevitable fact of life; however, it also seems to occur at an ever-increasing pace. Until as recently as the 20th century, family life in America was spent mostly out-of-doors, still in close contact with nature and the cyclical patterns of the seasons. Growing up as late as the 50's through 80's, children who are now mature adults spent much of their day playing outside in their yards, in their neighborhoods, on their farms, or in the woods. Parents encouraged their children to be outdoors; in many cases it was a necessity in maintaining the family's income. Many mothers seemed to prefer to have the children outside, perhaps so they would not be underfoot, making a mess indoors. This was the type of childhood that was taken for granted.

In just one or two generations, childhood in America and as well as in other countries has changed significantly. Population growth, smaller home lots, regulated neighborhoods and playgrounds, fewer wild spaces, new electronic forms of entertainment, and protective parents have all contributed to creating a different type of experience for children today. Instead, today's children are "containerized" and cut off from the natural contact that generations past had.

Research has been conducted on the influences of contact with nature on humans. Physicians, educators, psychologists, sociologists, and others have all discovered many benefits in nature immersion, as well as detriments to health and well-being from nature-deficit disorder. Howard Gardner, the author of the theory of multiple intelligences, has identified the “naturalist intelligence” as one of several critical forms of human intelligence. As humankind continues to modify the environment of planet Earth, there is a growing schism between the human species and nature. Is nature intelligence now on the verge of extinction? In our rapidly changing world--and one that faces unprecedented environmental challenges--what can be done to re-integrate the child with the cosmic whole with which he/she was once so connected?

Chapter 2: A Brief History of the Child and Nature

The setting for the evolution of human life has from the beginning been here on planet Earth. It is known as the blue planet that is not too hot, not too cold, but just right for supporting life forms. Our earliest ancestors lived in close relationship with nature. Their daily survival clearly depended upon their “nature intelligence.”

Nature may have multiple meanings for different readers. For the purposes of this paper, I will define “nature” as all the elements of the Universe *not built* by humans. It includes the Sun, stars, Earth, sky, weather, land and water forms, flora and fauna.

Without a well-developed knowledge of the plants and animals with which they shared the ecosystem, early humans would have perished. Howard Gardner, a professor of psychology at Harvard who developed the multiple intelligences theory, expresses the necessity of what he termed the “naturalistic intelligence:”

Clearly, the importance of a naturalistic intelligence is well established in evolutionary history, where the survival of an organism has depended on its ability to discriminate among similar species, avoiding some (predators) and ferreting out others (for prey or play). (1999, p. 49)

Philip Gang, author, Montessori educator, and the academic dean of The Institute for Educational Studies at Endicott College in Beverly, Massachusetts, has developed a model of four unique stages of human development through history. These periods are, in order: 1) the Age of Humanity in Nature, 2) the Age of Humanity with Nature, 3) the Age of Humanity over Nature, and 4) the Age of Humanity through Nature (Gang, 1989). I will examine the human experience in relationship to the Cosmos and nature here on Earth in each of these evolving

periods in an effort to come to a clear understanding of our ancestry, our shared experience as humans, and our needs going forward in re-integrating the child with the cosmic whole.

The Age of Humanity in Nature

Throughout the Paleolithic Period, humans lived deeply immersed in the patterns and rhythms of the natural world. Humankind's very survival depended upon a profound knowledge of edible plants, of how to stalk and hunt the animals with which they shared the land, and the ability to find water. Children would gather and hunt alongside their parents, developing their observation skills, learning where to find the desirable plants and berries and how to follow the herds. Thomas Berry, a historian and cosmotheologian, and Brian Swimme, a mathematical cosmologist, the authors of *The Universe Story*, describe the stored potential of those early human experiences as "...the stock of primordial memories that would influence all future generations.... The ever-recurring sequence of seasonal decline and renewal was making its impress on the human psyche as one of the most basic patterns..." (1992, p. 148).

Gang equates the Stone Age human with an infant, as our ancestors were undergoing the process of separating the "out there" from the "in here."

To grasp the essence of the early human observer all one has to do is to look closely at an infant as it makes its way into the world. As you watch an infant's attempt to grasp a finger held before its eyes...you are witnessing the early human observer. The child is becoming aware of the subtle division between itself and the outside world.

Consciousness is born out of one's ability to separate the "out there" from the "in here." Hunting and gathering tribes functioned at the level of the infant-explorer. They lived "in" nature because they were subjected to the whims and vicissitudes of their environment.... Theirs was a time of being in-nature, always trying to make meaning out of this relationship.

It was a life directly connected to the environment and there was little differentiation between the “out-there” and the “in-here.” Humanity and nature were one. (1989, pp. 23-24)

The Age of Humanity with Nature

With the advent of agriculture during the Mesolithic and Neolithic Periods, our ancestors revolutionized their existence. Humans learned to harness some of the forces of nature to their benefit by planting and cultivating crops. They were actively selecting which seeds to plant and were intervening in the vegetative world by breaking the soil, first with a digging stick, followed later by a hoe, and finally by the plow (Swimme & Berry, 1992). They were still subject to forces beyond their control, but were learning how to cooperate with nature to insure greater bounty for themselves and their families. Children would play an important role helping to plant and maintain the crops, as well as bringing in the harvest.

“Suddenly, man¹ and the plant came together... For the bread wheats can only multiply with help; therefore, man must harvest the ears and scatter their seeds; and the life of each, man and the plant, depends on the other (Bronowski, 1973: 68).” Human beings were no longer dominated by nature but were in the process of learning how to blend as equals with the natural environment. (Gang, 1989, pp. 24-25)

This period of co-existence *with* nature would continue through the great agricultural civilizations of India, China, Central and South America, and Greece. Greek philosophers in the sixth century B.C.E.--who did *not* see a division between the natural world, science, and religion--sought to understand φύσις, “physis,” the real nature or essence of things. This is the root for our word “physics.” “For the Greeks, logic and cause and effect ruled philosophic and scientific inquiry. This was the apex of Humanity with Nature” (Gang, 1989, p. 26).

¹ Throughout this paper I am retaining the non-gender inclusive language of the quoted authors even though that language is not used today.

The Age of Humanity over Nature

The next major shift in ages would begin with the European Renaissance. The new intellectual atmosphere of inquiry and investigation would eventually lead to an analysis of the natural world and a mechanistic view of the Universe.

The architects of this new age were Francis Bacon, René Descartes, and Isaac Newton. Together they created a model of the universe that was all-knowing and all-encompassing. A new spirit of inquiry evolved which urged the scientist to be critical, to use logic ruthlessly, and to analyze everything by taking everything apart.... [Bacon, Descartes, and Newton combined to establish]...the foundation for the mechanistic-industrial age. Their view of the world was a perfectly ordered giant machine that operated ad infinitum. (Gang, 1989, pp. 26-27)

The world of the child continued to include agricultural and perhaps even hunting chores that would keep the child in close contact with nature. However, the developing mechanistic age that would peak with the Industrial Age would have its own influence over education.

Nowhere is the mechanistic age more conspicuous than in the field of education where knowledge is separated into fixed categories and is parceled out in assembly-line fashion. The school favors competition over cooperation and achievement over integration. Modeled after the factory, mechanistic age schools have a covert curriculum in punctuality, obedience and in rote repetitive work. (Gang, 1989, p. 28)

The Age of Humans through Nature

The next age would be ushered in by the science of physics. The Newtonian worldview would be challenged by the revelations in the study of elementary particles. The discovery that Newtonian physics does not work to explain the “realm of the very small” would be earthshaking. “This discontinuity of energy emission shattered the Cartesian model of the Great Machine” (Gang, 1989, p. 30). Physicists could no longer explain a mechanistic Universe. With the advent of quantum physics, a new vision of the Cosmos emerged. Fritjof Capra, a theoretical

physicist, the Director of the Center for Ecoliteracy in Berkeley, CA, and the author of *The Web of Life*, states

“The universe is no longer seen as a machine, made up of a multitude of objects, but has to be pictured as one indivisible, dynamic whole whose parts are essentially interrelated and can be understood only as patterns of a cosmic process.” (Gang, 1989, p. 31)

The new model would result in a paradigm shift. Thomas Kuhn created the term “paradigm” in his book, *The Structure of Scientific Revolutions*. The first paradigm shift occurred in the transition from the wandering hunter-gatherer lifestyle to a settled agrarian society. The second shift came with the mechanization of the industrial revolution. Now the human species is on the cusp of a third paradigm shift, “...one that searches for a type of truly unified world view.... The ‘new’ science has developed the capability of confirming the pervasive unity which embodies the universe – as foretold by our religious and mystical ancestors” (Gang, 1989, pp. 19-20). Perhaps science will lead humanity--and the children--full circle back to a unity with nature.

The North American Frontier and “Nature Deficit”

The continent of North America might serve as a concise example of the different ages of human history. Berry contrasts the approach to the natural world that most of the native Americans had in North America in pre-Columbian times with what transpired when the Europeans arrived.

... [In] the indigenous cultures of this continent, certain models were established of how humans become integral with the larger context of our existence here on the planet Earth.... [On the other hand] we begin to realize that the European occupation of this continent, however admirable its intentions, has been flawed from the beginning in its assault on the indigenous peoples and its plundering of the land.... They had little comprehension of the devastation they were causing on this continent and throughout the

planet, a devastation that finally led to an impasse in our relations with the natural world. (1999, pp. 2-3)

Richard Louv, an environmentalist and the author of *Last Child in the Woods*, examines the more recent changes in the American economy and lifestyle that have led to a disconnection with the natural world. He uses the term “frontier” to explain these trends and tracks the changes that have occurred over the last two centuries in North America.

The “first frontier” was the period of westward settlement in the 19th century. Families still were immersed in the natural world and children spent a significant percentage of their time outdoors, helping their family to eke out a living by farming and hunting. Most families built their own homes from the natural resources that were available to them—timber and/or sod—and were quite self-sufficient in nature (Louv, 2008).

The “second frontier” was the period of small family farms in the early 20th century. The majority of American families lived on farms at the time. Agriculture was a dominant force in the economy, with most Americans engaged in growing their own food. Children were an integral part of this effort. The current school schedule of long summer vacations was a response to the need for children to help out on their farms, and it has not changed in most schools despite the fact that most Americans no longer live on farms (2008).

The “third frontier” is the current generation. It is decidedly more urban and technologically involved. The percentage of Americans who live on farms has dropped dramatically. Agriculture has become a big business in the United States, run for the most part by major corporations, not families. Now metropolitan areas have attracted the majority of the population and many people, including children, have limited contact with the natural world (2008).

In summary, over the millennia of humankind's history, there have been dramatic changes with regard to our relationship with the natural environment. Whereas time spent outdoors was once the majority of the day, now it is usually the minority. Furthermore, the natural environment has become diminished in size and degraded in quality, making contact with nature more difficult.

Chapter 3: Nature Intelligence

In light of these economic, sociological, and technological changes, psychologists, sociologists, ecologists, and educators among others, have attempted to identify the natural intelligence that was once taken for granted in previous generations. Gardner, in his work to define the multiple intelligences, has offered a description of what he has coined the “naturalist intelligence:”

The very term *naturalist* combines a description of the core ability with a characterization of a role that many cultures value. A naturalist demonstrates expertise in the recognition and classification of the numerous species—the flora and fauna—of his or her environment. Every culture prizes people who not only can recognize members of a species that are especially valuable or notably dangerous but also can appropriately categorize new or unfamiliar organisms. In cultures without formal science, the naturalist is the person most skilled in applying the accepted “folk taxonomies”; in cultures with a scientific orientation, the naturalist is a biologist who recognizes and categorizes specimens in terms of accepted formal taxonomies, such as the botanical ones devised in the 1700s by the Swedish scientist Carolus Linnaeus. (1999, p. 48)

Professor Leslie Owen Wilson, an educational psychologist at the University of Wisconsin, offers a list of descriptors for children with the eighth intelligence:

1. Have keen sensory skills, including sight, sound, smell, taste, and touch.
2. Readily use heightened sensory skills to notice and categorize things from the natural world.
3. Like to be outside doing activities...like gardening...observing nature....
4. Easily notice patterns from their surroundings....
5. Are interested in and care about animals or plants.
6. Notice things in the environment others often miss.
7. Create, keep, or have collections...about natural objects....
8. Are very interested...in television shows, videos, books...about nature.
9. Show heightened awareness of and concern for the environment and/or for endangered species.
10. Easily learn characteristics, names, categorizations, and data about objects or species found in the natural world (Louv, 2008, pp. 73-74).

Certain notable scientists and authors come readily to mind when considering the naturalist intelligence: Rachel Carson, John James Audubon, John Muir, Louis Agassiz, and E.

O. Wilson among others. Gardner emphasizes that the naturalist goes beyond just a taxonomic knowledge, to a profound respect and empathy for the natural world. “Exhibiting what Wilson has termed ‘biophilia,’ the naturalist is comfortable in the world of organisms and may well possess the talent of caring for, taming, or interacting subtly with various living creatures” (1999, p. 49).

Eva Selhub and Alan Logan are physicians and the authors of *Your Brain on Nature: The Science of Nature’s Influence on Your Health, Happiness, and Vitality*. Their belief is that our affinity for nature is embedded in our DNA.

Humanity’s historical contact with nature has left an indelible mark, a driving force for us to have an affinity for all things living (plants and animals alike). Our connection to nature is right there in our DNA: that’s the essence of the biophilia hypothesis. “Biophilia” was originally defined in early 1900s’ medical dictionaries as the instinct for self-preservation or the instinctual drive to stay alive. In the 1980s, Harvard biologist Edward O. Wilson proposed that biophilia is an “innately emotional affiliation of human beings to other living organisms.” (2012, pp. 8)

Maria Montessori, the first female Italian physician and an educational innovator and reformer, conducted observations of young children and concluded that they undergo distinct “sensitive periods” of development and basic human tendencies. Among those she included a sensitive period for order, activity and movement, exploration, sensory development, patterns, language, and mathematics (1949, 1973). To those, Gardner would add a sensitive period for nature.

Just as most ordinary children readily master language at an early age, so too are most children predisposed to explore the world of nature. The popularity of dinosaurs among five-year-olds is no accident! However, certain young children unquestionably show a pronounced early interest in the natural world, plus acute capacities to identify and employ many distinctions. Biographies of biologists [such as Darwin, Gould, and Wilson] routinely document an early fascination with plants and animals and a drive to identify, classify, and interact with them. (1999, p. 50)

The naturalist intelligence of recognizing subtle differences and/or patterns might also be applied to non-natural observations, such as distinguishing between models of cars, discerning patterns in a scientific lab, or making artistic distinctions. “Thus, it is possible that the pattern-recognizing talents of artists, poets, social scientists, and natural scientists are all built on the fundamental perceptual skills of naturalist intelligence” (Gardner, 1999, p. 50).

It is fairly obvious that in our post-industrial society, this intelligence is gradually becoming lost. Not only are people spending less time in close contact with the natural world, but also in the biology departments at the university level, the current emphasis is decidedly more on microbiology than zoology and the preservation of species.

In every bioregion, one of the most urgent tasks is to rebuild the community of naturalists, so radically depleted in recent years, as young people have spent less time in nature, and higher education has placed less value on such disciplines as zoology. (Louv, 2011, 2012, p. 131)

Berry concisely sums up how industrialism has altered the human experience of communion with the Universe. The context of our lives has been distorted by the artificial world that Westerners inhabit. We no longer feel our connection to the Universe, our true home.

[Indigenous peoples] ...live in a universe, in a cosmological order, whereas we, the peoples of the industrial world, no longer live in a universe. We in North America live in a political world, a nation, a business world, an economic order, a cultural tradition, a Disney dreamland. We live in cities, in a world of concrete and steel, of wheels and wires, a world of unending work. We seldom see the stars at night or the planets or the moon. Even in the day we do not experience the sun in any immediate or meaningful manner. Summer and winter are the same inside the mall. Ours is a world of highways, parking lots, shopping centers. We read books written with a strangely contrived human alphabet. We no longer read the Book of Nature.... We no longer read the book of the universe. We have extensive contact with the natural world through photographs and television presentations. But as Saint Augustine remarked long ago, “A picture of food does not nourish us.” (1999, p. 15)

David Abram, a sociologist, ecologist, and the author of *Becoming Animal: an Earthly Cosmology*, appears to agree with Saint Augustine in the comments he makes about the screen

supplanting actual experiences in nature. “You may...learn a great deal about lions by watching...a [television] program. But the primary lesson your organism steadily learns from the program is that nature is something you look *at*, not something you are *in* and *of*” (2011, p. 91).

However—perhaps without intending to—humankind is raising its children disconnected from the Universe. Is it because we ourselves have lost touch with the natural world, or because we feel that there is no economic value? Whatever the reason, we seem to be perpetrating a “crime” against nature and our children. This needs to change if our species is to live in harmony with our planet and to become whole again.

We initiate our children into an economic order based on exploitation of the natural life systems of the planet. To achieve this attitude we must first make our children unfeeling in their relation with the natural world. This occurs quite simply since we ourselves have become insensitive toward the natural world and do not realize just what we are doing. Yet if we observe our children closely in their early years we see how they are instinctively attracted to profound experiences of the natural world. We also see additional stresses, emotional disruptions, and learning disabilities that seem to originate in the toxic environment.... (Berry 1999, pp.15-16)

There is a special transcendence in the very real experience of nature, whether it is the watching of a sunrise, the observance of the flight of migrating geese, or admiring the night sky and finding the constellation Orion. Joseph Cornell, an environmental educator and the author of *Sharing Nature with Children*, notes that communing with nature is more than an identification exercise; there is a spiritual aspect to the wonder and magic one feels in that moment. “Some people have scientific, logical minds, while others are more sensitively attuned to beauty and harmony; and still others are moved most deeply by the eternal philosophical truths” (1979, p. 8).

I propose a slightly new term for the purposes of this paper—“nature intelligence.” Whereas Gardner’s naturalist intelligence focuses on identification and classification of the

natural world, an intelligence that is critical to conservation and preservation, I intend to use “nature intelligence” in a broader sense, taking into account Wilson’s biophilia and Cornell’s thoughts on attunement with nature. Its definition will include the ability to find harmony with nature, enjoyment and relaxation in nature, appreciation of the natural world, and the spiritual benefits of contact with nature.

Chapter 4: Nature-Deficit Disorder

One of the ironies of the third frontier is the lack of contact with nature; it is often so close, and yet so far away. Due to their loss of habitat as a result of housing developments, many wild animals are now crowded into closer proximity with humans. The deer population is the highest it has been in 100 years. Coyotes and mountain lions are often found near populated areas such as in Southern California and in the Front Range of Colorado. Regardless, Louv asserts that many Americans are experiencing a “nature deficit” (2008, p. 24).

Nature-deficit disorder describes the human costs of alienation from nature, among them: diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses. The disorder can be detected in individuals, families, and communities. (2008, p. 36)

Why a nature deficit in children? The technological age has created a world of electronic entertainment for children, keeping them indoors to play. Parents are also fearful of allowing their children the same independence that they themselves had while growing up. Fear of abductions by strangers looms in parents’ minds. Parents may feel that they would be negligent to allow their children out of their sight.

Jane Clark, a professor of kinesiology at the University of Maryland, suggests that children not only spend less time outdoors, but are also confined to smaller spaces. She calls them “containerized kids.” They spend time in car seats, in high chairs, and even in strollers pushed by their walking or jogging parents. Parents take many of these measures for “safety concerns,” but the long-term consequence is that the health of the immobilized children is compromised (Louv 2008, p. 35).

Another recent phenomenon of the third frontier is the “criminalization” of natural play. Private governments such as planned communities restrict, discourage, or ban the outdoor play

that many enjoyed as recently as the second frontier. Building permits are now required for what used to serve as spontaneous, child-created structures such as tree houses, or homeowner associations' covenants, codes, and restrictions limit the possibilities. Sometimes the restrictions in place are to protect *nature* from *human* incursions. As natural spaces are shrinking, the overuse of those remaining spaces by the growing human population is increasing. The reduced amount of leisure time spent outdoors by families means more time indoors in front of the television or computer, resulting in a growing rate of addiction to screen time and of obesity due to diet and inactive lifestyles (Louv, 2008, pp. 28-31).

It is not only in Western developed nations that this trend is occurring. This is a worldwide phenomenon that is getting notice in third world countries as well.

Some researchers have suggested that the nature deficit is growing fastest in English speaking countries. That may be true, but the phenomenon is occurring in developing countries in general. The *Daily Monitor*, published in Addis Ababa, Ethiopia, issued a plea in March 2007 for parents to get their children out of the house and into the outdoors, noting that "many Ethiopians will have reached adulthood far removed from outdoor experiences." (Louv, 2008, p. 35)

Over hundreds of thousands of years, the human experience with nature has evolved to the point that children today have a dramatically different relationship with the natural world than they had even just one or two generations ago. The author of *I Love Dirt*, Jennifer Ward, remarks upon the changes witnessed in merely the last fifty years.

In my great-grandparent's day, most people spent the better part of their lives outdoors... [T]he seasons were wired into their very being. They didn't have to think about nature as something to be attained, because it was integral in their lives, as it had been for untold generations. To be human was to be part of the natural world. (2008, p. ix)

Chapter 5: A Review of the Research

An increasing number of studies point to humankind's absolute dependence upon the natural environment, not "merely" as the habitat, but also as an *integral part of humans*, even on the level of the DNA.

The brain is absolutely influenced by nature, and it is no longer an option to write off the philosophers and poets as mere romantic dreamers. The results of the scientific investigations...should serve as a wake-up call for all of us. The mortality of individuals, nations, and even the planet itself is dependent on the recognition and acceptance that nature is part of us. Our perception of stress, our mental state, our immunity, our happiness, and our resiliency are all chemically influenced by the nervous system and its response to the natural environment. (Selhub & Logan, 2012, p. 33)

Louv agrees that based upon the results of studies by a widening circle of researchers, the shrinking natural habitat and the disconnection from nature has negative implications for child development and human health in general. "...[T]he quality of exposure to nature affects our health at an almost cellular level" (2008, p. 43).

Intelligence Quotient Trends

James Flynn, the New Zealand-based researcher and moral philosopher, first reported on an interesting phenomenon in human cognition in the 20th century. He noticed that throughout that century, there was a consistent trend of a rise in IQ of three to five points per decade in developed nations. This was called the "Flynn effect." Various factors may have explained this pattern: better nutrition, educational improvements, health care, and social factors. However, researchers are alarmed by the recent plateau and even reversal of the Flynn effect in IQ scores.

Large studies from different developed nations have reported a decline in IQ beginning in the late 1990s (in concert with the dawn of digital mania), such that a decade of IQ gains has been wiped out in the years 1998 to 2004. Even the good Dr. Flynn himself has reported on the reversal: his 2009 study indicated that British teens have experienced an

IQ drop from the 1980s' high point. The act of texting and checking e-mail removes 10 available IQ points. Albeit temporary, interruptions of this nature also destroy creativity and lead us down dead ends.... We are living in the age of distraction—ADHD rates in children and adults are off the charts. (Selhub and Logan, 2012, pp. 41-42)

The children of early humans would have learned at their parents' feet, observing and touching the natural world around them. The very young are attracted to small objects, such as stones, flowers, and insects. Rachel Carson, the renowned ecologist and author of *Silent Spring* and *Sense of Wonder*, observed, "Many children...delight in the small and inconspicuous" (1965, 2011, location 82).

Montessori conducted many observations of very young children in order to discern their fundamental tendencies and needs. She noticed the need to explore the environment, especially with their hands. Montessori believed that this is ingrained in humankind; it is a biological fact of our evolution as humans.

When we gaze at the stars, twinkling in the sky, ever faithfully following their orbit, so steadfast in their position, do we think: "Oh! How good the stars are?" No, we only say: "The stars obey the laws that govern the universe," and we say, "How marvelous is the order of creation!" A *form of order* in nature also appears in the behavior of children.... [O]rder came from mysterious, hidden, inner directives, which can manifest themselves only if the freedom permitting them to be heeded is given. In order to give this type of freedom, it was precisely necessary that nobody interfere to obstruct the constructive spontaneous activity of the children in an environment prepared so that their need for development can find satisfaction. (1955, 1976, pp. 43-44)

Attention Deficit/Hyperactivity Disorder

It has long been thought that exposure to nature is beneficial to both children and adults. In 1774, Johann Pestalozzi, a Swiss social reformer and educator, wrote, "Lead your child out into Nature. Tutor him on the hilltop and in the valley. There he will listen better, and the sense of freedom will give him more strength to overcome difficulties" (Selhub & Logan, 2012, p. 70).

Seemingly in corroboration of Pestalozzi, in recent years research is pointing to nature deficit as the underlying cause of the increase in attention deficit/hyperactivity disorder.

Consider that during the “first” and “second frontiers” of settlers and family farms, children spent the majority of their time outdoors performing chores that contributed to their families’ survival. Active and energetic children were prized for the work they were able to complete on their ranches or farms. There was an outlet for their energy and children were sincerely tired at the end of a normal day. However, so much has changed since then. Children now spend more time indoors pursuing sedentary activities such as video games. There are fewer opportunities for the physical expression of their energy. Hence, they do not become truly tired. Their previous connection to the natural world has been disrupted by the cultural and technological trends that define their lifestyles.

The Centers for Disease Control has reported an alarming jump in the number of children diagnosed with ADHD. In 2003, the percentage of children with ADHD was 7.8 percent. Then in 2007 it rose to 9.5 percent, and in 2011 it reached 11 percent. Angela Hanscom, a pediatric occupational therapist and the founder of an outdoor education program called TimberNook, suggests another reason for this seeming epidemic: the amount of time children are forced to sit in school (Strauss, 2014).

A 2004 study at the University of Illinois found a marked reduction in the symptoms of attention deficit/hyperactivity disorder after children engaged in activities conducted in green space, meaning natural areas including trees, shrubs, and possibly rock or water features. Cultivated and mown grassy areas do not count as green space. They used the data gathered from 452 parents of children diagnosed with ADHD.

Regardless of age, the presence or absence of hyperactivity in the child, economic bracket, geographic location within the United States, and rural or urban residence, activities in the green outdoors appeared to prove advantageous in reducing symptoms of attention deficit.... [T]he greenness of play areas was associated with milder symptoms of attention deficit and...windowless indoor play areas were associated with more severe symptoms. (Selhub and Logan, 2012, p. 71)

Similar research in Europe has yielded the same results. Exposure to green space seems to restore the brain's ability to focus in children who have been diagnosed with ADHD.

The results showed that performance on concentration tasks was higher in those [children] who had played in the wooded environment. The researchers concluded that the concentration and behavior was largely held constant among those in the wooded area, while in the built area it was at a lower level and more variable. (Selhub & Logan, 2012, p. 72)

In a separate study that was also conducted at the University of Illinois, children were taken for 20-minute walks in three different settings, including a park. Afterward they were given an assessment of their attention and executive functioning.

The results were clearly in favor of the natural setting as a cognitive enhancer—the children who had walked in the park knocked it out of the park: the improvement in cognitive function matched that reported for the two top-selling ADHD medications. (Selhub & Logan, 2012, p. 72)

Louv reflects upon the calming influence of his own time spent in nature as a child. He feels those early experiences endure beyond childhood into adulthood.

Now, my tree-climbing days long behind me, I often think about the lasting value of those early, deliciously idle days. I have come to appreciate the long view afforded by those treetops. The woods were my Ritalin. Nature calmed me, focused me, and yet excited my senses. (2008, p. 10)

Stephen Kaplan, a psychologist, has developed an “attention restoration theory.” He believes that natural environments easily engage our minds and require less effort on our parts to maintain our attention spans. Kaplan hypothesized that natural settings could restore attention effortlessly (Selhub & Logan, 2012).

Kaplan posited that natural environments are fascinating environments and, as such, they hold involuntary [effortless] attention without requiring the expenditure of energy in the brain that would otherwise cause cognitive fatigue. Nature experiences have the ability to promote a sense of cognitive clarity wherein there is an absence of confusion. (Selhub & Logan, 2012, p. 63)

Creativity, Sensory Deprivation and Atrophy

A Danish study in 2006 found that outdoor kindergartens stimulated children's creativity better than indoor programs. They reported that 58 percent of the children in touch with nature invented new games whereas only 16 percent of the indoor children did. One explanation might be the "loose parts theory" which purports that the more loose parts an environment provides, the more creative the resulting play will be. "In a tree, a woods, a field, a mountain, a ravine, a vacant lot, the number of loose parts is unlimited" (Louv, 2011, 2012, p. 34).

Louv suggests that a lack of contact with nature may lead to tunneled senses, feelings of isolation and containment, and an atrophy of the senses (2008). Developmental psychologists are aware that children live and learn through their senses. Robin Moore, a professor who directs a research and design program at North Carolina State University, is concerned that the lack of touch with nature may lead to negative consequences. Technology cannot replace the experiences of touch that nature provides. The result is sensory deprivation and sensory atrophy (Louv, 2008).

Beyond that, Nancy Dess, a senior scientist with the American Psychological Association expresses the concern that lack of touch leads to serious problems. As people separate from touch with nature, they are also separating from other humans. "As we grow more separate from nature, we continue to separate from one another physically. '... Without touch, infant primates, die; adult primates with touch deficits become more aggressive'" (Louv, 2008, pp. 66-67).

Dealing with Stress

Selhub and Logan point out that research indicates that nature deprivation in childhood may lead to long-term difficulties dealing with stress and a weakened immune system. Beyond that, this deficit may also cause environmental apathy with future generations caring little about the planet's sustainability.

Less contact with nature, particularly in one's young years, appears to remove a layer of protection against psychological stress and opportunity for cognitive rejuvenation. Japanese research suggests also that nature deprivation may have wide-ranging effects on the immune system. In the big picture, our turn away from nature is associated with less empathy and attraction to nature and, in turn, less interest in environmental efforts related to nature. An obvious concern is that a massive withdrawal from nature will immunize us against empathic views of nature. Sustainability of the planet is not merely about being a good citizen and recycling; it is ultimately about maintaining an intimate relationship with nature. Research shows that in order to truly care about "being green," one must actually have meaningful exposure to nature. (2012, p. 3)

Nature has long been regarded as a health tonic. Healers from various cultures, such as the Ayurveda of India and traditional Chinese medicine, have prescribed nature exposure as medical treatment. The mountains, rivers, and forests have been thought to be founts of healing energy, a vital force, which can be absorbed by patients (Selhub & Logan, 2012).

Parks in the United States were planned due to the belief that nature was of benefit to urban populations. Frank Law Olmsted, the landscape architect and promoter of parks, held the opinion "...that parks had a beneficial impact on positive mental health" (Selhub & Logan, 2012, p. 11). Furthermore,

Within the medical profession during the early 1900s there was largely an acceptance of—and in some quarters enthusiasm about—the beneficial effects of the nature retreats. The anecdotal notion was that nature could have a medicinal effect, providing a tonic for the brain as it dealt with a world that was becoming increasingly complex. Along with writing out prescriptions for some time in nature, physicians were making note that a

sedentary and indoor lifestyle was at odds with our human lineage. From urban-park planners to medical doctors, all hypothesized that nature is in us, it has shaped us, and even though we may turn away, we do so at our own peril. (Selhub & Logan, 2012, p. 13)

Roger S. Ulrich, a geography doctoral student at the University of Michigan, investigated the effects of nature scenes on stressed college students. First, he administered a one-hour exam in a windowless room. Next, he had his 46 volunteers take some psychological assessments and finally, they viewed around 50 slides. Ulrich found the nature scenes increased their positive feelings—“...feelings of affection, playfulness, friendliness, and elation were elevated in the group that viewed various nature scenes. Not so for those who viewed the urban scenes. Those views significantly cultivated one emotion in these stressed students: sadness” (Selhub & Logan, 2012, p. 14).

In his follow up research, Ulrich found that nature acted as a “visual valium”; the nature scenes created positive emotions and lowered aggression levels. “For many of the participants, not only did the nature scenes offset the effects of the stressful video [they had watched] but their reports of positive mental outlook were higher than their pretest scores” (Selhub & Logan, 2012, p. 16). Ulrich’s research has since been supported by additional studies conducted in Texas, Kansas, Taiwan, and Japan. Overall, the results have shown improved health indicators, such as lower blood pressure, lower heart rate, less muscular tension and fatigue, and better memory recall after viewing nature scenes compared with viewing built urban scenes. (Selhub & Logan, 2012).

Another large-scale study that involved 21,000 students from Seattle, Fort Collins, and Orange County found that classroom window areas had a distinct effect on the students’ learning rates in those rooms. “...[S]tudents in classrooms with the largest window areas progressed as much as 15 percent faster in math and 23 percent faster in reading than students in classrooms

with few windows” (Selhub & Logan, 2012, p. 96). In a separate study conducted in 101 public Michigan high schools, they also found that the students in rooms with larger windows and more views of nature [trees, shrubs, flowers--mown grass was not beneficial] had higher standardized test scores and graduation rates, and a greater percentage planned to attend college (Louv, 2011, 2012). A third study completed in Canada, “...showed that greening school grounds not only improved academic performance of students; it also lowered exposure to toxins and increased teachers’ enthusiasm for being teachers, in part due to fewer classroom discipline problems” (Louv, 2011, 2012, p. 29).

Similar results have been found with the presence of plants within classrooms. Studies have shown that those rooms with a moderate number of green plants seemed to influence students’ feelings of well-being, their performance on tests, and improved the general behavior patterns of the class (Selhub & Logan, 2012).

Other positive effects have also been shown when there are plants in the classroom. Researchers at the University of Technology in Sydney, Australia, found significant improvements when four indoor plants were placed in school learning environments. In a study involving over 350 students, significant improvements ranging from 10 to 14 percent were noted in mathematics, spelling, and science in the students who had had plants in their classrooms for six weeks (Selhub & Logan, 2012).

One of the factors that may contribute to the healthful environment that is found in a forest is the presence of negative ions. What exactly *are* negative ions? Denise Mann, a health reporter for *WebMD* explains:

Negative ions are odorless, tasteless, and invisible molecules that we inhale in abundance in certain environments. Think mountains, waterfalls, and beaches. Once they reach our bloodstream, negative ions are believed to produce biochemical reactions that increase levels of the mood chemical serotonin, helping to alleviate depression, relieve stress, and boost our daytime energy. (2002, p. 1)

Forests and bodies of moving water have an abundance of negative ions. Negative ions seem "...to promote our antioxidant defense system, lower blood lactate levels, and improve aerobic metabolism by enhancing blood flow" (Selhub & Logan, 2012, p. 98).

Gordon H. Orians, a renowned ornithologist, behavioral ecologist, and professor emeritus in the Department of Biology at the University of Washington, "...maintains that our attraction to the natural environment exists at the level of our DNA, and, in its many genetic forms, haunts us" (Louv, 2011, 2012, p. 53).

Orians and Judith Heerwagen, a Seattle-based environmental psychologist, spent years surveying people around the world, testing their preference for different images. The researchers found that, regardless of culture, people gravitate to images of nature, especially the savanna, with its clusters of trees, horizontal canopies, distant views, flowers, water, and changing elevations. (Louv, 2011, 2012, p. 54)

Researchers Kaplan and Raymond DeYoung found that the best antidote for mental fatigue that is caused by too much directed attention (which they term "voluntary attention") is "*involuntary* attention." When we humans are in natural environments that provide a certain sense of fascination, so much so that involuntarily we cannot help but pay attention, we seem refreshed and relaxed. Unlike the "voluntary attention" which we direct to our work and studies, the mental escape from the day-to-day routines that nature provides is especially effective in helping us overcome mental fatigue (Louv, 2011, 2012).

In a program that reported greater mental acuity after time spent in nature, John Hockenberry, an NPR commentator shared an anecdote about Einstein. "...[H]e pointed out that Albert Einstein and the mathematician and philosopher Kurt Gödel, 'two of the most brilliant people who ever walked the face of the earth, used to famously, every single day, take walks in the woods on the Princeton campus'" (Louv, 2011, 2012, p. 33).

It may even be possible that nature experiences in childhood contribute to future intelligence. "In 1977, the late Edith Cobb, a noted proponent of nature-based education, contended that geniuses share one trait: transcendent experience in nature in their early years" (Louv, 2011, 2012, p. 34).

Outdoor education programs have proven to be beneficial to students who lack regular contact with nature.

So-called at risk students who have not had much experience in nature show a marked improvement of 27 percent in test scores, related to mastery of science, when they learn in weeklong residential outdoor education programs. They also showed enhanced cooperation and conflict-resolution skills; gains in self-esteem; gains in positive environmental behavior; and improvements in problem solving, motivation to learn, and classroom behavior. Typically, these studies controlled for socioeconomic status, racial/ethnic makeup, building age, and size of enrollment. (Louv, 2011, 2012, p. 30)

Shinrin-Yoku

In 1982 the Japanese Forest Agency initiated a program called "shinrin-yoku." Literally, the translation is "forest bathing," but broadly it means "taking in the forest atmosphere with all of our senses." The goal of the program was to encourage health by getting more Japanese to go out into nature, "...to literally bathe the mind and body in greenspace" (Selhub & Logan, 2012, p. 18). Yoshifumi Miyazaki of Chiba University conducted a follow-up study in 1990 and found

that compared to equivalent activities completed indoors, the outdoor activities in a cedar forest improved mood and levels of vigor, as well as lowered the stress hormone cortisol. Later studies confirmed that time spent in a forest setting can reduce stress, depression, and hostility, and at the same time improve sleep (Selhub & Logan, 2012). Furthermore, Qing Li, a medical researcher from the Nippon Medical School, found that shinrin-yoku may have benefits for the immune system. The phytoncide (a mixture of natural chemicals) secreted by evergreens seems to improve the efficacy of our immune systems (Selhub & Logan, 2012). Miyazaki's conclusion is, "Humans...lived in nature for 5 million years. We were made to fit a natural environment... When we are exposed to nature, our bodies go back to how they should be..." (Louv, 2011, 2012, p. 51)."

In independent studies in California and Korea, researchers have found that patients in hospitals recover more quickly when they have windows that look out upon nature views and that there is less perception of pain under those conditions, requiring less analgesic medication. Typically, patients have shorter hospital stays when their room has a view. Plants and flowers in the patients' rooms were also found to improve the patients' conditions. (Selhub & Logan, 2012).

Attraction to Water

A similar phenomenon seems to occur when subjects view scenes with water features such as oceans, lakes, and waterfalls. There appears to be a near universal attraction to water. This may be due to the higher levels of negative ions near water features, a characteristic shared with mountains and forests.

Respondents in a study ranked nature scenes with water higher than other nature scenes without it. “Our attraction to water is evident. Both children and adults consistently rank water environments among their favorite places, and vacations and leisure activities often take place in aquatic environments” (Selhub & Logan, 2012, p. 100). The underlying attraction to water is most likely biological. Our ancestors instinctively sought it out in their effort to survive. We cannot live without water. It is natural that we should be attracted to it. The surface of water would have appeared as the shiniest substance in early humans’ environment, catching their eyes easily as they scanned the horizon for water sources. Perhaps we are still attracted to shiny objects as a vestige of that adaptation. Wallace Nichols, a marine biologist and the author of *Blue Mind: The Surprising Science That Shows How Being Near, In, On or Under Water Can Make You Happier, Healthier, More Connected, and Better at What You Do*, summarizes this compelling attraction:

There’s something about water that draws and fascinates us. No wonder: it’s the most omnipresent substance on Earth and, along with air, the primary ingredient for supporting life as we know it. For starters, ocean plankton provides more than half of our planet’s oxygen.... Water covers more than 70 percent of Earth’s surface; 95 percent of those waters have yet to be explored. From one million miles away our planet resembles a small blue marble; from one hundred million miles it’s a tiny, pale blue dot. (2014, location 212)

Outdoor Versus Indoor Exercise

Studies that have compared and contrasted exercise indoors to exercise outdoors found that the majority of both adults and children prefer the outdoors.

...[E]lectronic monitoring demonstrates that children who go outside to play will have a two-and-a-half-fold increase in physical activity which is an obvious deterrent to obesity.... [Adults] Jogging through the woods resulted in faster completion times, more satisfaction, more enjoyment, and less frustration than the open laps [around a track]. (Selhub & Logan, 2012, p. 116)

An article in *American Journal of Preventive Medicine* concurs that access to nearby green space helps to put a diet of outdoor activity on our figurative plates, serving as a control to the spiraling trend of obesity in the United States and other developed nations.

Nearby nature can be an antidote to obesity. A 2008 study published in *American Journal of Preventive Medicine* found that the greener the neighborhood, the lower the Body Mass Index of children. “Our new study of over 3,800 inner city children revealed that living in areas with green space has a long term positive impact on children’s weight and thus health,” according to senior author Gilbert C. Liu, M.D.... The results support those who believe that changing the built environment for inner-city kids is just as important as attempts to change family behavior. (Louv, 2011, 2012, p. 47)

Additional studies have shown that aerobic fitness in children is strongly correlated with an extended attention span and that children with the best balance have the most efficient working memory. Therefore, outdoor physical activities seem to improve attention, memory and, of course, fitness levels (Selhub & Logan, 2012).

Ultimately, our health and longevity depend a great deal on the workings of something very small—mitochondria. The mitochondria in each of our cells control the transformation of oxygen and nutrients into usable energy. Exercise is directly linked to the functioning of mitochondria.

At the primal level, how we age depends upon the health of mitochondria. Today almost every plant and animal uses mitochondria to transform air and nutrients into energy. Every cell in our bodies contains some two hundred to three hundred mitochondria. These are our cellular power plants. They’re also engaged in other processes, including cell differentiation, cell growth, and cell death. The mitochondria are happily employed until their lives are overwhelmed by free radicals. ...“The more exercise someone does, the more the cell releases antioxidants to protect it,” [says William Bird, one of the UK’s leading voices for connecting people to nature]. “So a child who plays outside in a natural green space will reduce the chance of developing chronic diseases later in life.” (Louv, 2011, 2012, pp. 80-81)

Beyond the many physical benefits, green exercise may also provide us a transcendent experience that unifies our minds and bodies with nature. Perhaps it fulfills a need that some people seek to satisfy instead with recreational drugs. The “runner’s high” is a healthy and natural alternative to drug use.

By contrast, the high achieved through deep green exercise opens the senses; this high is about transcendence, about natural ecstasy. Australia’s noted nature philosopher Glenn Albrecht has come up with a name for this spontaneous euphoria, this feeling of oneness with the earth and its life forces: ‘eutierria’ (*eu* = good, *tierra* = earth)” (Louv, 2012, p. 76).

Gardening and Nutrition

Horticultural programs likewise seem to have a positive influence on children, improving motivation, communication skills, stress reduction, sleep, social skills, and self-esteem (Selhub & Logan, 2012). These benefits have long been recognized, as this quote from *Ladies’ Home Journal*, dated 1898, illustrates: “The soil is the child’s best friend” (Selhub & Logan, 2012, p. 159). Gardening provides significant time outdoors as well as exercise. Exposure to nature also seems to reduce allergies. Beneficial bacteria in the soil aids in the development of healthy immune systems in children (Selhub & Logan, 2012). Early studies have indicated that *Mycobacterium vaccae*, a common bacteria that is ingested or inhaled when we garden, improved learning in mice (2011, 2012). Children with gardening experiences also developed healthier eating habits and better relationships with the natural world.

Researchers at Texas A & M University found that elementary students who had experience with seeds, planting and transplanting, using garden tools, and caring for plants in raised garden beds displayed more positive environmental attitudes than school students who were not exposed to the garden intervention. (Selhub & Logan, 2012, p. 165)

Nutrition also may influence cognitive abilities in children. Researchers in the United Kingdom have compared the IQ levels of children who were fed a diet of relatively unprocessed foods, high in whole foods, to those children who had a diet high in processed convenience foods.

Researchers in the United Kingdom collected nutritional data provided by mothers and caregivers of 3-year-old children and then followed up with them five and half [sic] years later, administering IQ tests to the children, by then aged 8 ½. Children who had consumed the highest amounts of fatty and sweet processed convenience foods had significantly lower IQ results compared with the children who consumed higher amounts of fish, greens, fruits, vegetables, and grains. Habitual sugar intake and an elevated intake of saturated fats have also been associated with compromised cognitive functioning in healthy adults. (Selhub & Logan, 2012, p. 192)

There is growing evidence that there is a serious vitamin D deficiency in the American populace. Estimates range from 50 to 75 percent of teens and adults may suffer from inadequate levels of vitamin D, whose main source is sunlight.

African Americans are especially at risk, one researcher explains in *Scientific American*, because “they have more melanin or pigment in their skin that makes it harder for the body to absorb and use the sun’s ultraviolet rays to synthesize vitamin D.” ... [T]here is agreement that vitamin D blood levels are dropping and that deficiency is associated with a large number of health problems, including cancers, arterial stiffness in African American teens, type 2 diabetes, lower mood levels during winter, decreased physical strength in young people, and decreased lung function for children with asthma. Vitamin D also has been found beneficial in reducing risk for some infectious diseases, autoimmune diseases, fractures, and periodontal disease. (Louv, 2011, 2012, p. 48)

The Influence of Animals

Our experiences with animals, both wild and domestic, seem to have long-lasting health benefits according to recent studies. Contact with and care of other species promotes empathy, responsibility, and feelings of well-being. Keeping pets also seems to increase physical health and longevity. Research subjects preferred viewing nature scenes with animals to similar scenes

without them. “Volunteers rated the scenes that included animals more positively and identified the humans depicted in these scenes as more likeable, friendly, happy, confident, and less stressed than those in scenes where there was no animal” (Selhub & Logan, 2012, p. 140).

Perhaps the recently noted rise in pet ownership is an unconscious attempt by our population to find a source of nature contact in a world that is increasingly nature deprived.

...[A] rise in pet ownership [may meet] a fundamental drive for nature contact in an increasingly synthetic world.... [P]etting an animal could minimize stress on the blood circulatory system compared with other activities, including reading....[A study of heart patients]...showed that 28 percent of the individuals who did not have pets died within the same year, whereas only 6 percent of the pet owners died during the same time frame. (Selhub & Logan, 2012, p. 129-130)

In a Japanese study in 2002, researchers found that even keeping a pet as simple as a goldfish in childhood seemed to provide children with a foundation in marine biology and improved their abilities to apply biological principles to other species (Selhub & Logan, 2012, p. 136).

Several other studies of pet ownership have indicated that childhood experiences in pet care, especially dogs, helps to create an empathic brain.

It is becoming increasingly clear that experience with animals early in life leads to a more empathic brain later in life.... [A] number of studies have shown that pet ownership (of dogs in particular) in childhood is positively linked with empathy during the early years, and it is also predictive of subsequent empathy in adulthood” (Selhub & Logan, 2012, pp. 137-138)

Nature Deficit Causes Social and Psychological Breakdown

Humans are living members of the animal kingdom. Ingrained in our physical make-up, we have needs for certain elements in our living environment. Like other species in the animal kingdom, we react when deprived of those fundamental needs.

Humans living in landscapes that lack trees or other natural features undergo patterns of social, psychological, and physical breakdown that are strikingly similar to those observed in animals that have been deprived of their natural habitat. “In animals, what you see is increased aggression, disrupted parenting patterns, and disrupted social hierarchies,” says Frances Kuo, a professor at the University of Illinois, who, with her colleagues, has studied the negative impact of de-natured life on human health and well-being. Among them, they have noted decreased civility, more aggression, more property crime, more loitering, more graffiti, and more litter, as well as less supervision of children outdoors. “We might call some of that ‘soiling the nest,’ which is not healthy,” she says. “No organisms do that when they’re in good shape.... In our studies, people with less access to nature show relatively poor attention or cognitive function, poor management of major life issues, poor impulse control.” (Louv, 2011, 2012, p. 64)

A new form of psychotherapy called “ecotherapy” is seeking to address the needs of a human population increasingly impacted by nature-deficit disorder. This nature-guided therapy is becoming accepted in mainstream psychology as a method that addresses the stress of urban life and the shrinking access to green space. Psychotherapist Linda Buzzell-Saltzman of Santa Barbara, California, describes this new practice as “...the reinvention of psychotherapy as if nature mattered” (Louv, 2011, 2012, p. 65).

The Lure of Technology and the Danger of Environmental Generational Amnesia

We have seen a dramatic increase in the use of technology by all age levels since the 1980s. While screen gadgets such as video games, tablets, and cell phones affect all ages, in the formative years of brain development during childhood the results may be irreversible. On the other hand, exposure to nature at an early age appears to help the development of the brain’s right hemisphere in our very left-brained society.

An article in *Maclean’s* magazine (Canada) commented upon the possible deleterious results of too much screen time in early life.

One view is that people who experience too much technology in the formative years will stunt the maturation of normal frontal lobe development, “ultimately freezing them in

teen brain mode.”... Are we developing a generation with underdeveloped frontal lobes, unable to learn, remember, feel, control impulses?” (Louv, 2011, 2012, p. 38)

As we raise our children, we may need to keep in mind that a balance of technological knowledge with knowledge of the natural world is essential to their health and well-being, a “hybrid mind” (Louv, 2011, 2012, p. 39). “Virtual nature,” which is a growing phenomenon in this technological age, poses its own dangers. While it may benefit us to watch programming about endangered species or other aspects of nature, it is not an adequate replacement for the real thing.

An expert at the University of Washington in technology-nature-human interaction, Peter H. Kahn, warns of what he calls “environmental generational amnesia.” He believes that virtual nature ultimately becomes normal to us. Although it is helpful to a certain degree, “...combined with a lack of appreciation of what [nature] once was, it masks the severity of environmental problems” (Selhub & Logan, 2012, p. 222).

Indeed, environmental generational amnesia exists even beyond the virtual world. As each successive generation comes into the world, the environmental conditions have been degraded from those of the previous generation. However, the new generation does not know any better, and comes to take the degraded condition for granted as a pristine version of the world. Over time and with succeeding generations, humankind has come to accept a seriously impacted natural world as the standard by which we will measure any future ecological damage, completely out of touch with what a healthy ecosystem once was.

Conclusion

Studies seem to indicate that as a species humans stand to benefit considerably by recognizing their needs—physical, cognitive, social, emotional, and spiritual—to connect with the natural world. Humankind appears to have lost its way over time, causing damage not only to itself, but also to the natural environment.

There is a personal loss here: we are becoming less aware of the mentally rejuvenating and cognitively restorative benefits of nature. There is also an environmental loss: a collective detachment is not in the interest of conservation. Although there is much talk about environmental awareness and “being green,” when it comes to being green in the true sense—connecting with nature and actually being *in* green in a mindful sense—our society is losing its way. Screen-based gadgets are luring us away from nature and all its benefits. It’s not possible to cultivate true concern and empathy for nature while being completely detached from it. True connectivity in any relationship, be it interpersonal or with elements of nature, serves to strengthen empathy and concern. Mostly, we stand up for what we know and what we have experienced. Yet, at a time when we need conservation efforts more than ever, when we need a little stress relief more than ever, we are turning our backs on nature. (Selhub & Logan, 2012, pp. 54-55)

Next I will examine Berry’s vision for restoring the human-nature relationship to a mutually beneficial partnership.

Chapter 6: A Vision for the Ecozoic Human

“Now I see the secret of the making of the best persons: it is to grow in the open air and to eat and sleep with the earth” (Whitman, 1860, 1965, p. 139).

Poets, artists, romantics, farmers, outdoor enthusiasts, traditional healers, nature lovers, and others have known this secret for ages. There is something about our connection with nature that feels so right. Our earliest ancestors lived by this credo; that is just the way life was for the first humans. Perhaps we still feel an exhilaration in nature, since that is how our species happened to evolve and we deeply sense that connection. Or maybe it was predetermined--nature *dictated* how our DNA would unfold all along and it simply is *not* possible *not* to feel connected.

However, now humankind faces a crisis the likes of which we have not seen before. Our own impact on nature has affected the Earth so profoundly that we are now threatening not only the survival of many other life forms, but our very own existence as well. We have become so disconnected from our cosmic source, that we have seemingly lost the ability to sense and act upon the dangers we ourselves are causing. What do humans need to do to step back from the seeming edge of extinction? How must humankind evolve to the next level of enlightenment and live cooperatively *with* the Earth, rather than *on* it as a burden, even as a destroyer?

Berry traces the history of the North American continent in an attempt to understand how humankind has evolved over the last couple of millennia and has finally arrived at this ecological point of crisis. He points out that the First Peoples to occupy North America had an intimate relationship with the land. Their survival was dependent upon a keen understanding of the Earth and they sought the aid of greater powers through various ceremonies. Harmony with the environment was key to their cultures (1999). There was a balance between the abundance of

nature and human consumption thereof. Hunters only took what was needed for their families and gave thanks to the Great Spirit for their sustenance. The animal whose life was sacrificed was honored and there was no waste of its body; the Native Americans used not only the meat, but all the parts, including the teeth, the skin, and the bones.

This was the America that the first Europeans who stepped on its shores found. These explorers were generally greeted by Native Americans who had a long tradition of living with the land—but not owning it. They welcomed the Europeans with the idea that there was plenty to go around and assisted their new neighbors by instructing them, as did Squanto, or by trading goods with them, as did the Powhatan of Virginia.

However, these Europeans did not venture to North America with harmony in mind. Theirs was, instead, a business venture. The London Company, which eventually became known as the Virginia Company, was an investment firm. As a corporation, they were seeking to make profits in the New World. The natives were a means to an end; if they could help to turn a profit in some way, they were used for that purpose. If the natives could not, then they were pushed out of the way, or worse. “European presence was less occupation than predation” (Berry, 1999, p. 45). Even the Pilgrims, those humble voyagers in search of religious freedom, were financially backed by profit seekers in Europe who hoped that the new continent held financial promise.

[The Europeans] could not understand that their inability to commune with the land would result in the devastation of the continent.... As seen by the Europeans the continent was here to serve human purposes through trade and commerce as well as through the more immediate personal and household needs of the colonists. They had nothing spiritual to learn from this continent. Their attitude toward the land as primarily for *use* was the crucial issue. (Berry, 1999, pp. 43-44)

Wildness was perceived as an enemy by the settlers; it prevented the economic expansion that the Europeans sought. This new world would need to be tamed so that the resources could more easily be harvested and put to human use (Berry, 1999).

The new settlers saw it as their “manifest destiny” to occupy the whole of the continent, coast to coast. Their Native American friends were eventually pushed aside to make room for the Europeans’ westward expansion—or exterminated. The new technologies that would develop in the industrial age would be viewed as improvements to the human living conditions. Few, if any, questioned the wisdom of these forms of “progress” or considered the ultimate consequences on the natural world, whose resources were believed to be infinite.

Berry calls this current economy “extractive.” The extractive economy has three characteristics: 1) an anthropocentric view of the universe, 2) the natural world is seen as a threat to the well-being of humans, and 3) human conquest of the forces of nature (1999). It seems so extractive, in fact, that “[i]t is estimated that to support our present Earth population at the level enjoyed in North America would require two or three planets” (1999, p. 114).

Berry would suggest that what humanity needs is to return to the recognition that our ancestors had—that we are part of a single integral community. Earth has human and other-than-human members; each being has a critical role to play in the ecosystem. Our interpretation of our presence here on this Earth needs to become more democratic, giving voice to the other-than-human inhabitants who have been under-represented due to humankind’s self-centered attitudes and actions. “... [E]very being has rights to be recognized and revered. Trees have tree rights, insects have insect rights, rivers have river rights, mountains have mountain rights” (1999, p. 5).

Berry continues to clarify that, as members of this single integral community, humans also have the rights to habitat, nourishment, and shelter. There is a balance, however. We do not have the right to deprive the other-than-humans of their rights to the same.

Roger Fouts, a renowned primatologist and the author of *Next of Kin: My Conversations with Chimpanzees*, holds strong opinions about humankind's history of diminishing the rights of non-human entities as well. We include those who are like us in our circle of rights, and exclude those who are different. Humans do this to other humans, and we do this especially to other life forms on the planet. He feels that our flawed moral code should disturb us. "This fact should trouble any person who believes that moral principles should be applied rationally and universally" (1997, 2003, p. 368). He sees nature as a great continuum; we are all related to each other since we share a common origin. It is not possible to draw a line anywhere along this continuum to separate ourselves from another element of nature (1997, 2003). Berry agrees with Fouts when he states, "We now know ourselves as genetically related to every other living being in the universe" (1999, p. 83).

The following chart from the Koshland Science Museum website shows some results of DNA tests that link us to other-than-human life forms:

Table 1.

Tracing Similarities and Differences in Our DNA: What percent of their genes match yours?

Another human?	100% - All humans have the same genes, but some of these genes contain sequence differences that make each person unique.
A chimpanzee?	98% - Chimpanzees are the closest living species to humans.
A mouse?	92% - All mammals are quite similar genetically.
A fruit fly?	44% - Studies of fruit flies have shown how shared genes govern the growth and structure of both insects and mammals.
Yeast?	26% - Yeast are single-celled organisms, but they have many housekeeping genes that are the same as the genes in humans, such as those that enable energy to be derived from the breakdown of sugars.
A weed (thale cress)?	18% - Plants have many metabolic differences from humans. For example, they use sunlight to convert carbon dioxide gas to sugars. But they also have similarities in their housekeeping genes.

<https://www.koshland-science-museum.org/explore-the-science/interactives/putting-dna-to-work#.VKNm7ieod-U>

Lauren de Boer, a TIES adjunct professor and a facilitator in one of the eCampus

Integrative Seminars, comments on the surprising revelations of genetic research:

This is fascinating, that an unexpected outcome of genetic research - the Human Genome project - was this finding that we share so much of our genetic mapping. The expectation by some was that we would finally learn what makes human beings so different from other species. Mapping of the genome and that of other species certainly threw those assumptions under a different light. (2014)

Now there is actual scientific proof of the close relationships all life forms bear to one another. In the past, humans have erroneously presumed vast differences between us and other-than-human life forms. That presumption has been used as a basis to claim superiority and the right to exploit other life forms for the sake of the human economy, denying the rights of animals and plants.

Berry and Fouts are not alone in their critique of the current denial of rights to all.

Marilyn Waring, a member of the New Zealand Parliament, a feminist and environmental activist, expresses her concern over the misguided economic system that governs our world. She feels that in our current system, the planet itself is not recognized for its ecological value.

Furthermore, Waring has witnessed that the work of women, children, and the poor is not viewed as contributing to the economy in many nations. She feels that our society has been operating under a misguided economic system that does not value life (Nash, 1995).

Montessori asserts that humankind is victimizing itself, unable to free itself of its many inventions, and needing a new relationship with the environment.

The real enemy is man's impotence against his own products; it is the arrest of development of humanity itself. To vanquish this enemy, man has only to react to and behave in a different manner towards the environment, which in itself is a source of wealth and happiness. A universal revolution is what we need. This revolution requires only that man should raise his values and become the master, instead of the victim, of the environment he himself created. (Montessori, 1955, 1976, p. 18)

J. Krishnamurti, a world-renowned spiritual teacher, is of a like mind with Berry, Fouts, Waring, and Montessori. He urges us to be more aware of our relationships, with people, property, ideas, and nature. Krishnamurti advises a fundamental change in human values and outlook. "What we must realize is that we are not only conditioned by environment, but that we *are* the environment—we are not something apart from it" (1953, 1981, p. 55).

What Is the Great Work?

Berry proposes the direction that he views as essential to solving our ecological dilemma. He calls it the "Great Work." "Overarching movements" that connect us to the universe have marked our history. The creation of this type of movement could be called the Great Work of a society.

Berry continues by delineating what that Great Work might look like for us at this point in time:

The Great Work now, as we move into a new millennium, is to carry out the transition from a period of human devastation of the Earth to a period when humans would be

present to the planet in a mutually beneficial manner. . . . Such a transition has no historical parallel since the geobiological transition that took place 67 million years ago when the period of the dinosaurs was terminated and a new biological age begun. So now we awaken to a period of extensive disarray in the biological structure and functioning of the planet. (1999, p. 3)

No age lives isolated unto itself from the rest of history. Kahn expresses his concern over the phenomenon of environmental generational amnesia. The danger inherent in this “amnesia” is that

...people take the natural environment they encounter during childhood as the norm against which they measure environmental degradation later in their life. With each ensuing generation, the amount of environmental degradation increases, but each generation takes that degraded condition as the nondegraded condition—as the normal condition. (2002, location 73)

Berry, too, thinks that generations do not exist in isolation. “No age lives completely unto itself. Each age has only what it receives from the prior generation” (1999, p. 7). He feels that history has bestowed upon us a special role to play. The Great Work of our time is to transform current humanity into a new kind of human, one that is deeply connected with its cosmic origins, one that “is present to the Earth.” Berry found support in the writings of Montessori and he quotes her:

...She notes in her book, *To Educate the Human Potential*, that only when the child is able to identify its own center with the center of the universe does education really begin. For the universe, she says, “is an imposing reality.” It is “an answer to all questions.” “We shall walk together on this part of life, for all things are part of the universe, and are connected with each other to form one whole unity.” “... [N]o matter what we touch, an atom, or a cell, we cannot explain it without knowledge of the wide universe.” (1999, p. 16)

Montessori would call it our “cosmic task.” This cosmic task is an overarching theme in Montessori education. When the child is grounded in the laws of the Universe, it is likely that he or she will ask, “What am I? What is the task of man in this wonderful universe? Do we merely live here for ourselves, or is there something more for us to do?” (1948, 1973, p. 10).

Berry states that we did not *choose* this role—it was chosen for us. He encourages us that we are capable of this task, as he believes “...that those powers that assign our role must in that same act bestow upon us the ability to fulfill this role. We must believe that we are cared for and guided by these same powers that bring us into being” (1999, p. 7).

What can humankind do, I wonder, to restore the natural balance of the ecosystem we call home? It appears that the Great Work before us is for humankind to regain its sense of wonder and connection with the Universe. Valerie Lishnoff, a Montessori teacher and a student enrolled in the master’s program with The Institute for Educational Studies (TIES) at Endicott College, commented in a seminar: “By participating in our own lives and universe in a more active, compassionate, and self-aware manner, we will create positivity in our own lives and affect great changes in our environment” (2014, July 9). It seems that it is a part of our very biological being to feel a part of the greatest whole that we know. Our ancestors of long ago acknowledged their connections by honoring the Universe and the planet in their rituals. However, we have lost that knowledge by concealing it behind our mundane world of daily obligations and global economics. Berry advises us to remember that...

[t]he beginning of wisdom in any human activity is a certain reverence before the primordial mystery of existence, for the world about us is a fearsome mode of being. We do not judge the universe. The universe is even now judging us. (1999, p. 50)

Living in the Universe Again

Many of us who live in the industrial age no longer seem to see ourselves as a part of a Universe. Instead, we may be deluded into believing that we live only in our homes and our communities with jobs in a town or a city that is made of concrete and buildings. If so, we might be deceived from perceiving the vast Universe by the glow of our own city lights. Unlike our ancestors before us, we have created an illusion of reality that limits and prevents us from

connecting with our true and ultimate origins. How many of us look at the sunrise and sunset? When is the last time we admired a starry night? It appears to be a vicious circle that is difficult to escape since we dwell in the economy that drives the illusion.

Wheatley emphatically agrees with Berry, stating, “It has not been easy living in this universe [of classical physics]. A mechanical world feels distinctly anti-human” (1994, p. 29). The implications for a future in harmony with the Earth are that humankind will need to make some radical changes. The way the economy revolves around the consumption of resources will need to undergo a purposeful re-design.

It seems part of the natural order to return to a way of life that more closely resembles our ancestors’ relationships to the Earth and the Universe. Observations of children may reveal the way. Biology predisposes young humans to be attracted to the natural world. It is our culture that seems to rob us of our youthful, instinctive attraction. The questions become, “How do we regain that attraction?” and, “How do we prevent the loss from happening in the first place?”

The “Reformation”

Berry made three fundamental observations about the Universe and humankind’s current state of disconnection. Perhaps these three key points can serve as a map to reforming our current world and finding our way to the Ecozoic human? 1) We awaken every day as a part of the Universe, 2) the Universe is highly differentiated, and 3) the “...various forms of expression [in the Universe] are so intimately related that nothing is itself without everything else. Nothing exists in isolation” (1999, p. 147).

If we are to succeed in reinventing the human, because, as Berry points out, the human is the species most capable of self-invention, we will need these points as guidance (1999).

Berry's vision is that the solution will need to be sought in a four-pronged manner through existing institutions: 1) governments, 2) corporations, 3) religions, and 4) education. Where do we proceed from there?

Many of us who are part of large and small systems have felt the futility of accomplishing common goals when attempting to work together within institutions. Margaret Wheatley, a former professor of management and the president of The Berkana Institute, addresses the issue of helplessness within our organizational systems. She has some suggestions that might be employed by governments, corporations, religions, and educational institutions to effect the critical environmental changes that are needed.

Several years ago, I read that elementary particles were "bundles of potentiality." I have begun to think of all of us this way, for surely we are as undefinable, unanalyzable and bundled with potential as anything in the universe. None of us exists independent of our relationships with others. (1994, p. 34)

In positive relationships that acknowledge everyone's contributions, Wheatley sees a path out of our inefficacy.

To live in a quantum world, to weave here and there with ease and grace, we will need to change what we do. We will need to stop describing tasks and instead facilitate *process*. We will need to become savvy about how to build relationships, how to nurture growing, evolving things. All of us will need better skills in listening, communicating, and facilitating groups, because these are the talents that build strong relationships. (1994, p. 38)

These strong relationships hold the potential for the Earth's survival, and our own. It all comes down to one simple word, *love*, sounding as if one were listening to a Beatles' song. "Love in organizations, then, is the most potent source of power we have available. And all because we inhabit a quantum universe that knows nothing of itself, independent of its relationships" (Wheatley, 1994, p. 39).

Krishnamurti echoes Wheatley's thoughts when he speaks of the necessity for love:

Only love can bring about the understanding of another. Where there is love there is instantaneous communion with the other, on the same level and at the same time. It is because we ourselves are so dry, empty and without love that we have allowed governments and systems to take over the education of our children and the direction of our lives; but governments want efficient technicians, not human beings, because human beings become dangerous to governments—and to organized religions as well. That is why governments and religious organizations seek to control education. (1953, 1981, pp. 23-24)

Here I would add that in my observations, it seems corporations as well have sought to control education, and still do as testing increasingly invades the classrooms. In my school district, the current school year has fifty-five days of testing “windows”—that is, days of possible testing. This trend seems to be driven by the testing companies themselves and the corporations, who seek workers to supply the American work force. Additionally, there is a movement to hold teachers ever more accountable for student achievement. Student achievement on tests is a factor in teacher evaluations in my district, the Denver Public Schools, and teacher compensation is directly tied to student performance on tests. If government and business control the teachers, surely they control education.

Wheatley's thoughts carry an optimism that I do not always feel when considering the lack of action by governments, corporations, religions, and educational institutions. It is easy to feel a sense of discouragement and pessimism about the Earth's future as it continues to experience an escalation in climate instability, ice caps melting, and species disappearing. Feeling small in my efforts, I find solace in the words Gandhi was known to speak, hoping for encouragement: “What you do may seem insignificant, but it is most important that you do it.” As one tiny individual in the huge scheme of the Universe, all that I can do is *do what I do* to work for change. From there, it seems one must have faith.

Speaking as an educator, how might I pursue the course that education might take to bring humankind into the Ecozoic Era? I will examine how Berry views the mission of educational institutions:

Our educational institutions need to see their purpose not as training personnel for exploiting the Earth but as guiding students toward an intimate relationship with the Earth. For it is the planet itself that brings us into being, sustains us in life and delights us with its wonders. In this context we might consider the intellectual, political, and economic orientations that will enable us to fulfill the historical assignment before us—to establish a more viable way into the future. (1999, p. x)

We know more now than ever before in terms of possessing a scientific knowledge of the workings of the Universe. As educators, our resources are considerable; we have more books, more educational programming on video, and the seemingly infinite possibilities of the Internet. However, all of these riches of information cannot replace the direct experiences of communing with the Universe and planet Earth.

Berry looks to the universities and to their responsibilities in reforming humankind and the faulty economic model that has led us to this brink of ecological collapse. I ask myself, is the university level early enough in a child's life? My belief as a Montessori educator is that the reformation could begin much earlier than the university. Our greatest hope lies in following the natural inclinations of the young child, who still deeply feels connections with the Earth.

...Somehow we must reach...back, to where our human genetic coding connects with the other species codings of the larger Earth community. Only then can we overcome the limitations of the anthropocentrism that binds us. Perhaps a new revelatory experience is taking place, an experience wherein human consciousness awakens to the grandeur and sacred quality of the Earth process. (Berry, 1999, p. 106)

Perhaps it is necessary to reach back to the child to find answers to this challenge. I often do. Looking back at my own childhood, I spent the majority of my time playing outside.

Speaking from personal experiences, I was the type of child who had to be coerced to come

indoors. My backyard was full of fruit trees, farm buildings, hiding places, a creek, and a pond. The outdoors were so intriguing to me, even a call to dinner fell short of convincing me to leave my natural playground. Louv would explain this attraction by stating that nature is full of “loose parts.”

A typical list of loose parts for a natural play area might include water, trees, bushes, flowers, and long grasses; a pond and the creature within it, along with other living things; sand (best if it can be mixed with water); places to sit in, on, under; structures that offer privacy and views. Go beyond that play area, to woods, fields, and streams, and the parts become looser and even more potent to the imagination.... Nature, which excites all the senses, remains the richest source of loose parts. (2008, p. 87)

Anyone who has observed very young children has seen the wonder in their eyes when they play amongst the trees, lie in the tall grass with the wildflowers, or discover a new animal. It seems that the biological connections as well as the psychological ones are incontrovertible—nature, with its many “loose parts,” holds a compelling attraction. Perhaps little children still feel the strong sense of connection because they are new to the world and have not yet had nature nurtured out of them... although it hardly seems that the way children are raised to value modern possessions over the natural world should be called “nurturing.”

Louv quotes the art critic Bernard Berenson as he reflects on the profound effect nature had on him as a boy:

“In childhood and boyhood this ecstasy overtook me when I was happy out of doors... A silver haze shimmered and trembled over the lime trees. The air was laden with their fragrance. The temperature was like a caress. I remember... that I climbed up a stump and felt suddenly immersed in Itness. I did not call it by that name. I had no need for words. It and I were one. Surely most children are like that.” (2008, p. 86)

Our goal as a society seems to be--if we are to raise the new Ecozoic humans--to preserve the original biophilia of this child. This is increasingly difficult in a world where contact with

nature is more and more difficult to come by due to many factors. In the last century, several causes have emerged:

- The majority of the population lives in urban spaces.
- Wild spaces are shrinking due to human population growth.
- Common wild spaces, such as parks, are regulated and often restrain children's activities in an attempt to preserve the wilderness.
- Working parents' schedules limit how much children are able to play outside; structured days inhibit children from playing in free and creative ways in nature.
- Children are more and more sheltered and protected by parents in response to perceived social dangers, real or imagined, resulting in "containerization" (Louv, 2008, pp. 28-34).

A widening circle of researchers believes that the loss of natural habitat, or the disconnection from nature even when it is available, has enormous implications for human health and child development. (Louv, 2008, p. 43)

In short, many children are experiencing a nature deficit. This is not just a danger in the developed world of western society, but also in the third world.

Conclusion

In reality there is a single integral community of the Earth that includes all its component members whether human or other than human. In this community every being has its own role to fulfill, its own dignity, its inner spontaneity. Every being has its own voice. Every being declares itself to the entire universe. Every being enters into communion with other beings. This capacity for relatedness, for presence to other beings, for spontaneity in action, is a capacity possessed by every mode of being throughout the entire universe. (Berry, 1999, p. 4)

I find myself wishing that Berry were still alive today to guide us through the dilemmas in which humankind finds itself. There is something soothing and encouraging about his paternal

words of wisdom, so I keep returning to his sage thoughts for inspiration. The environmental crises of today are often frightening to me; I need the comfort of his words. This “capacity for relatedness” that we all possess may be critical at this point in time.

Regaining a respect for all other life forms seems to be a first step for us. For many ages, humans have moved away from respect to a habit of abuse. Our species raises animals for slaughter and experimentation, as if it is right to treat them that way. The abuse is in the slaughterhouses and in the laboratories, where we experiment on living, feeling creatures—including our closest relatives, the chimpanzees—with no thought of the torments we are inflicting. The abuse is evident in the clear cutting of forests, the reduction of animal habitats, and the pollution of the air, the land, and the water. Just name it and humankind has done it, all for the sake of “progress” and economic gain.

It seems that the extractive economy has extracted from the Earth to the point of endangering the very ecosystem that humans inhabit. What are the needed changes in the way humankind thinks and especially in the way we act if we are to preserve the only planet that we can call our home? Should we reform ourselves and evolve for the Ecozoic Era? Will it require the innate wisdom in the youngest members of humankind to lead us in the right direction? The sages Berry, Fouts, Krishnamurti, Montessori, Muir, Wheatley, and Whitman all point to solutions. I ask myself, is humankind intelligent enough to truly follow? Am I?

Chapter 7: The Big Picture – What Can We Learn from Chaos?

In seeking solutions to re-integrate the child into the world of nature, it may help to take a look at the big picture and examine the origins of our Universe. I will now explore how the originating chaos of the Universe has implicit lessons for us all. *The Seven Life Lessons of Chaos* by authors John Briggs, a professor of English, and David Peat, a professor of physics, might serve as a general framework. These life lessons proved to be personally very powerful. I found myself returning to these revelations again and again. The seven lessons helped to integrate my learning, my teaching, and my approach to life. I feel that they might serve us well as a foundation for educators who are involved in bringing forth the Ecozoic human.

The lessons are 1) chaos is creative and self-organizing, 2) the “butterfly effect”, 3) “co-evolution” and “cooperation”, 4) the paradox of the simple and the complex, 5) fractals, 6) living within time, and 7) rejoining the whole (Briggs & Peat, 1999).

What Is Chaos?

In contemporary usage, chaos has several definitions:

1. A state of utter confusion or disorder; a total lack of organization or order.
2. Any confused, disorderly mass: a chaos of meaningless phrases.
3. The infinity of space or formless matter supposed to have preceded the existence of the ordered universe.
4. (Initial capital letter) The personification of this in any of several ancient Greek myths.
5. Obsolete. a chasm or abyss. (“Chaos,” n.d.)

The two most commonly used meanings have negative connotations, giving chaos a seemingly bad reputation. One must note that those with neutral connotations, definitions three and four, however, are the ones used by the authors, Briggs and Peat.

Dating back to ancient history, Chaos was an element in the creation myths of many cultures, including the Greeks, the Vikings, Egyptians, and Chinese. Since the word “chaos” itself is of Greek origin (ΧΑΟΣ), let us take a look at what the ancient Greeks believed. Among the Greeks there were several accounts of the origin of the Universe. In one myth, classical scholar Charles Mills Gayley explains, “...Night and Darkness were the prime elements of Nature and from them sprang Light” (1893, 1939, p. 3). Yet another myth,

...attributed to Orpheus, asserts that Time was in the beginning, but had himself no beginning; that from him proceeded Chaos, a yawning abyss wherein brooded Night and Mist and fiery air, or AETHER; that Time caused the mist to spin round the central fiery air till the mass, assuming the form of a huge world egg, flew, by reason of its rapid rotation, into halves. Of these one was Heaven, the other Earth. (1939, p. 3)

The philosopher Aristotle credits the Greek poet Hesiod with saying, "First of all things was chaos made..." (Hope, 1966, p. 12).

Chaos in *The Seven Life Lessons of Chaos* is the creative, powerful force of the Universe. “...Nature uses chaos in remarkable ways to create new entities, shape events, and hold the Universe together” (Briggs & Peat, 1999, p. 1). It feels comforting to me to consider that there is a force holding us all together and seems novel to think that it is chaos’ job. From its very beginning, the “Big Bang,” the energy and eventual order of the Universe emerged from chaos. Everything had its origin in chaos. In fact, “subatomic particles formed within the first moments of the ‘big bang’ birth of the Cosmos are still contained within our bodies in ordered forms” (Briggs & Peat, 1999, p. 4).

The Universe seems to have been born out of chaos and we ourselves are of the Universe. It appears valuable and pertinent to acquaint ourselves better with the origins of our very beings.

Being Creative

I will begin to examine the seven life lessons of chaos. The first one is that chaos is creative and self-organizing.

...[W]e ourselves are composed of the [universal] material constantly flowing through us. Our “shape” is created and sustained by the flux of which we are part. We are what we eat, what we breathe, what we experience from our environment. (Briggs & Peat, 1999, p. 16)

Every manifestation of the Universe self-organizes out of the original chaos into its ultimate form--stars, solar systems, planets, mountains, oceans, and life.

Swimme and Berry, call this self-organizing principle “autopoiesis,” which comes from the Greek roots “auto” and “poiesis,” meaning “self-making, self-creating” (1992, p. 75). (The term was first coined by Chilean biologists, Humberto Maturana and Francisco Varela, whose work I will examine in greater detail in Chapter 8.) Neurological research has found that the developing human brain is self-constructing because when the neurons repeatedly use the same pathways, the neurons are wired together to create efficient connections that, in turn, become habits and forms of intelligence.

Lishnoff reflected in an online discussion of an interview with Swimme in Montessori Learning Insights (13:34),

I loved the idea that humans were present at the birth of the universe in one form or another, in an implicit way. The human is “profoundly cosmic” and we “carry the imprint of the whole universe.” Certainly the children in my class do. (2014, February)

Montessori concluded from her studies of young children that they are self-organizing from birth. The first three years of life she termed “the spiritual embryo,” stating that humans undergo a second embryonic stage of self-construction after birth. As discussed earlier, in childhood humans experience several “sensitive periods,” one of which is for order. By this she

meant that the young child of three to six years of age is particularly sensitive to order in the environment, learning about orderly relationships from the teacher and preferring the same predictable routine and arrangement of furnishings and materials. In this manner the child incarnates from an orderly environment an internal sense of order.

In Montessori's theory, one can see that through a series of focused periods of development, i.e., sensitive periods for the development of order, language, mathematics, and social relationships, children create themselves. A prepared environment, a governing principle of Montessori education, provides a range of activities for the developing child in each sensitive period. Many of the activities are in the form of "games" such as "the bank game," "the snake game," and "the detective triangle game" that will appeal to the children as they experience each period of sensitivity. These games teach concepts such as matching numbers and quantities, adding small sums, and identifying triangles through the use of adjectives and make the learning fun.

Montessori was not alone in her recognition of how children construct themselves through play. De Boer, shared this thought by Donald Winnicott, a 20th century pediatrician and psychoanalyst who studied child development: "It is in playing and only in playing that the child or adult is able to be creative and to use the whole personality, and it is only in being creative that the individual discovers the self" (2013).

Fouts observed the same phenomenon in his work with primates. He writes:

From Washoe I learned the greatest secret of working with chimpanzees and human children: make an activity a game and they'll do it forever. Ask them to do it, or force it on them, and they lose interest immediately. (1997, 2003, p. 34)

Play is nature's way of fusing complex behaviors and creating intelligence that is adaptive to new situations. It is nature's version of school, a school where there are no teachers per se, just interesting adults that can be watched and imitated. (2003, p. 82)

Starting with our childhoods, each of us is our own product of these on-going acts of playful self-creation. There is

...a kind of power or force that is at work in the mind of the child. It is a unifying force taking direction from the inner drives which take it to seek its own perfection. It is a creative energy that permits the child to participate in ones [sic] own development – to be an agent of ones [sic] own self creation. (Gang, 1989, p. 13)

When chaos self-organizes, that moment becomes ripe for an “aha” experience. Everyone has probably had those “light bulb” moments when everything seems to click and one reaches a new level of profound understanding. Those magical moments may be triggered by an event or thought that might be inconsequential to others, but is absolutely precious in one's personal experiences (Briggs & Peat, 1999).

“Chaos, it turns out, is as much about what we *can't* know as it is about certainty and fact. It's about letting go, accepting limits, and celebrating magic and mystery” (Briggs & Peat, 1999, p. 7). This is more easily said than done for me and, perhaps, for many people. It seems easy to develop the notion that we have control over our own lives, and perhaps the lives of others as well.

The ideal of “being in control” is so much a part of our behavior that it has become an obsession, even an addiction.... Chaos suggests that instead of resisting life's uncertainties, we should embrace them.... Painters, poets, and musicians have long known that creativity blossoms when they are participating in chaos. (Briggs & Peat, 1999, p. 8)

I wonder if human autopoietic, self-organizing tendencies react to any new chaos as a threat to the well-worn neural pathways that have become habitual. In other words, our habits resist the changes that accompany chaos. Letting go, accepting limits, and celebrating magic and

mystery--I found this to be constructive advice at a stage in my life when there was a lot of change. It was helpful to embrace my chaos and transitions as an opportunity to grow and to become stronger. Change allowed me to discover new and improved aspects of myself. If chaos helped me to learn life lessons and grow stronger from them, I wondered, why do most of us seem so resistant to it?

Imanthi Nanayakkara, a Montessori teacher and a graduate student enrolled in TIES, inquired in the eCampus Integrative Seminar 1 (1:32), "Does the idea of loss of control evoke anxiety?" (2013). It seems to me that it may be an act of self-preservation—the self-organized self attempts to protect the patterns in the worlds that it has built. It is paradoxical, since those convenient and efficient habits with which one believes to "control" one's life originally emerged from chaos in the first place. Then, along comes chaos to announce, "Time to rid oneself of assumptions and start over."

Lorie Federman, a trainer of Montessori primary teachers and a graduate student in TIES, shared this tidbit about the philosopher/author Ram Dass, who suffered a devastating cerebral hemorrhage, in the same seminar: "In the movie 'Fierce Grace', a biography of Ram Dass, he mentions that after all of his spiritual work, he 'flunked the test' and was in fear when he had his stroke" (2013).

For me this was an "aha" moment. Here was Ram Dass's brain thinking about itself spinning into chaos, resisting it. His experience reminded me of a book about strokes, *My Stroke of Insight* by Jill Bolte Taylor, a neuroanatomist. A massive cerebral hemorrhage shut down her brain's left hemisphere so that she was living a right-brained experience for a long period of time. The insights she had while in her "right brain" were life changing. While she probably would not

have chosen to have her stroke, Taylor also concluded that she would not want to go back to being the person she was *before* she had the stroke. The life lessons and insights she gleaned from the loss of control she had over her situation were so profound that she treasured the new person she had become and was awed by the power of the revelations.

How on earth would I exist as a member of the human race with this heightened perception that we are each a part of it all, and that the life force energy within each of us contains the power of the universe? (2006, p. 70)

Butterfly Power

A Chinese proverb states, “[T]he power of a butterfly’s wings can be felt on the other side of the world” (Briggs & Peat, 1999, p. 31). Lesson two is about the power of subtle factors. Often it is the seemingly little factors that have an enormous influence on the whole. The collective power of many small efforts can total up to a sum capable of producing change. Although we each may seem to wield little power in the big scheme of the Universe, we also all possess “butterfly power.”

This, again, reminds me of the Gandhi quote, “What you do may seem insignificant, but it is most important that you do it.” The butterfly effect helps us to make sense of his words. If each individual’s efforts help to put into motion some kind of progress toward the ultimate goal of evolving humankind and improving life on our planet, it is essential that each of us maintains our courage to do our own part. Gandhi urges us to hold onto the faith that what we contribute *does* matter...at least as much as the butterfly in the Chinese proverb.

Butterfly power underlines just how deeply influential ordinary individuals can be in society. But it also points to the fundamental humility necessary to exert this influence in a positive way.... [W]e can never be sure how important our own individual contribution will be. Our action may be lost in the chaos that surrounds us, or it may join with one of those many loops that sustain and replenish an open, creative community.... The best we

can do is act with truth, sincerity, and sensitivity, remembering that it is never one person who brings about change but the feedback of change within the entire system. (Briggs & Peat, 1999, pp. 49-50)

Nanayakkara (2014, January) commented in the eCampus Montessori Learning Insights conference, topic “Education and Peace” (10:7):

The Montessori teacher's role is to be a servant to the child, carefully observing and always preparing the environment to ensure that the child's needs are always met. That noble service taken on is an act of kindness which is the best way to "teach" by simply acting and doing. The same is for instilling peace within the classroom or anywhere around us. Acts of kindness and generosity first and foremost begin with myself. Through role modeling and butterfly effect, nature provides opportunities for further acts of kindness to occur.

Looking again to Gandhi for his profound wisdom, “We must be the change we wish to see in the world” (2002, p. A34). Like the butterfly, we each have an effect during our lifetimes. Every little contribution counts.

Coevolution and Cooperation

Lesson three illustrates how biology is full of *coevolution* and *cooperation* more than competition. In the past, evolutionary theories have abounded with notions of survival of the fittest, promoting the idea of competition. “Chaos theory shifts perspective and allows us to appreciate the fact that biology is full of ‘coevolution’ and ‘cooperation.’ These activities probably have a far more significant impact on the shape of things than does competition” (Briggs & Peat, 1999, p. 60). Natural history is rife with examples of coevolution. To cite one example, when flowering plants with seeds enclosed in fruits evolved 100 million years ago, the animals that would distribute the seeds by eating the fruits had to evolve along with them (Briggs & Peat, p. 62).

Coevolution and cooperation are not new concepts. Native Americans seem to have long recognized a need to understand the connectedness--the unity--of life and the need to cooperate.

The following poem was inspired by the words of Chief Seattle:

This we know.
All things are connected
like the blood
which unites one family...

Whatever befalls the earth,
Befalls the sons and daughters of the earth.
Man did not weave the web of life;
he is merely a strand in it/
Whatever he does to the web,
he does to himself.

Ted Perry (Capra, 1996, dedication)

Drew Dellinger, a spoken word poet, professor, writer, activist and founder of Poets for Global Justice, stated, "All space, all time, and the potential for everything that would ever exist started as a single point, so in a very real sense science has discovered what indigenous people have known all along: we are all one, we are all connected, we all come from the very same source" (Rogin, 2006).

Capra clarifies the concepts of cooperation, coevolution, and connectedness as a holistic worldview that results in an ecological awareness.

The new paradigm may be called a holistic worldview, seeing the world as an integrated whole rather than a dissociated collection of parts. It may also be called an ecological view, if the term 'ecological' is used in a much broader and deeper sense than usual.

Deep ecological awareness recognizes the fundamental interdependence of all phenomena and the fact that, as individuals and societies, we are all embedded in (and ultimately dependent on) the cyclical processes of nature (1996, p. 10).

If we have deep ecological awareness, or experience, of being part of the web of life, then we *will* (as opposed to *should*) be inclined to care for all of living nature. Indeed we can scarcely refrain from responding in this way. (1996, p. 12)

Montessori used many examples of coevolution and cooperation to illustrate the unity of all life. In one of the key lessons presented to elementary children in Montessori schools, it is pointed out how early on in the evolution of marine life on Earth during the Paleozoic Era, crinoids absorbed the oversupply of calcium in the oceans, thus re-balancing the water's composition so other life forms could survive. Remember that Montessori used the term "cosmic task" for this concept. She believed this task, as with everything in the Universe, also applies to humanity.

Montessori viewed education as a vehicle for arriving at this discovery. Why are we here? What is our purpose? Her philosophy of "Cosmic Education," was based upon this concept.

"If the idea of the universe be presented to the child in the right way, it will do more for him than just arouse his interest, for it will create in him admiration and wonder...." Montessori called the plan for this kind of learning "Cosmic Education." ... Ultimately what is being suggested is that the student should discover that humanity's cosmic task is to continue collectively, the work of creation on Earth, and to discover with its intelligence the endless latent possibilities of the world's creations. (Gang, 1989, p. 77)

The Simple and the Complex

Chaos theory tells us that when life seems to be the most complicated, a simple order may be just around the corner. And when things appear simple, we should be on the lookout for the hidden nuance and subtlety. (Briggs & Peat, 1999, p. 89)

This is one of the paradoxes of life.

Paradox is central to the ways Eastern philosophy attempts to see the truth beyond our restrictive ideas of reality. In a famous passage from the Taoist Chuang Tzu, the master dreams he is a butterfly and then wonders if he is really a butterfly dreaming he's a man. (Briggs & Peat, p. 80)

And, I would ask, if humans are really the Universe, then are we not *both* the butterfly and the human?

When simplicity and complexity alternate, they create a phenomenon scientists have termed "intermittency." Intermittency is the occasional burst of chaos that emerges and seemingly "disturbs" the regularity of patterns.

The ancient mathematicians were themselves disturbed when they discovered intermittency. Pythagoreans, in their efforts to explain the regularity of the Universe through mathematics, were puzzled when confronted with the irrationality of the number π . Whereas rational numbers are either finite, or like $1/3$, repeat in a regular pattern, an irrational number is infinite and has no order (Briggs & Peat, 1999, p. 87). Pi and the square root of 2 so disrupted the perceived harmony of mathematics that the Pythagorean brotherhood actually suppressed the information for a while, not knowing how to accommodate this threat to their orderly Universe of numbers.

This leads us back to the paradoxical question once again:

Does chaos emerge because regular behavior has temporarily broken down? Or is regular order really a breakdown of reality's underlying chaos?... Many societies give intermittency an explicit role. [Carnivals, fiestas, Halloween, and Mardi Gras]... Such bursts of chaos allow the good order of society to continue throughout the rest of the year. (Briggs & Peat, 1999, p. 85)

Chaos as an intermittent event, however, sometimes is unwelcome. It can interrupt our lives in unpleasant, inconvenient ways, such as in the form of illness, death, or other challenges. Most of us would not wish to have these difficulties, but there is often a silver lining. These

events might make us stronger, more spiritual, and can bring the members of a family together in a bond that might not otherwise have been achieved.

I experienced this a year ago in the passing of my beloved father. He was a wonderfully loving patriarch, treasured by his children and grandchildren. All came together to pay him homage before he passed on, and we grew closer to each other through that emotional experience. Each of us realized what he meant to us both individually and collectively and we emerged with a new and deeper understanding of love and family.

Simplicity and complexity seem to be two points on the same circular continuum. Are they simply distinguished by degrees? Can they truly be separated from each other? At what point does the simple become the complex, and vice versa?

One of my favorite quotes of all time is by the American naturalist and the pioneer in the national park movement, John Muir: “When we try to pick out anything by itself, we find it hitched to everything else in the universe” (1911, p. 110). To illustrate, look at this example. The biologist Lewis Thomas suggested that we try to understand completely just one infinitely small organism, like a protist found in the gut of a termite. One would soon realize that it is impossible.

Because chaos tells us that everything is ultimately connected to everything else, gaining really deep knowledge about the protozoan would require understanding its connection to the entire history of evolution and the entire dynamics of its environment. What is true of a protozoan is true of ourselves. To fully know oneself would require, in effect, understanding the whole Universe. (Briggs & Peat, 1999, p. 91)

Federman (2013) also points out inter-connectedness in her comments in eCampus

Integrative Seminar 1 (1:8):

“...Each of us as an individual is inter-connected to the systems of nature, society, and thought that surround and flow through us” (Briggs & Peat, p. 4). I do believe that there

is an invisible thread running through our universe. When a work of art speaks intimately to me, I feel connected to the artist, as if I can feel the emotion of the artist come through the painting, or composition. In that moment, there is no time. A masterpiece made hundreds of years ago still carries that feeling and is transported to the viewer whose heart is open to receive.

Simplicity and complexity—they sum up the duality of life. Duality can take other forms, however, such as sameness and difference. For instance, many conflicts in history have developed out of human perceptions of sameness and difference, self and other. “Our side” (sameness) versus “their side” (difference) is the fundamental basis for tribal conflicts, nationalism, politics, and sports as well. These simplifications are an attempt to paint a complex world in black and white.

But when our simplifications lead us to idealize or denigrate others, we’re in danger of losing touch with the reality of our actual connections. Perhaps one of the reasons that we experience such secret satisfaction in feelings of anger and hate is that they seem to make the world simple and clear-cut. (Briggs & Peat, 1999, p. 93)

People seem to find comfort in painting the world as black and white. However, I feel instead it is mostly comprised of many shades of gray. How does one get beyond the pitfalls of duality? The good news seems to be that chaos theory can offer a way out.

Chaos theory, with its simultaneous acceptance of simplicity and complexity, order and chaos, One and Many, self and other, comes closest to the world’s traditional wisdom.... Chaos invites us to adopt new strategies of life, to walk the tightrope between oversimplifying choices by ignoring subtlety and overcomplicating direct action and clear decisions. Our survival as infants and adults depends upon the brain’s ability to abstract patterns. Yet this great skill works against us when we get stuck and project simplicities instead of attending to differences.... The brain has a nasty habit of clinging to its simplified way of framing something so that after a time the frame becomes the reality. But we shouldn’t despair over our faulty projections, stereotypes, and habitual prejudices. Chaos theory tells us we were also born with the power to overcome them. (Briggs & Peat, 1999, pp. 97-98)

Montessori sought to overcome them by offering a new vision of education that led to unity and broke down the barriers created by nationalistic duality. She lived through World War

I and World War II and witnessed firsthand the negative effects of nationalism. Montessori herself fled Fascist Italy in World War II because her ideas were not welcomed under Mussolini's regime.

In the Montessori method, unlike in traditional education which emphasizes *patria*, the home nation first, the approach to the teaching of history is to emphasize the "big picture," starting with the creation of the Universe, the solar system, the formation of the Earth, and then the evolution of life on Earth. The Timeline of Life investigates the different forms of life as they appeared. Humankind appears late on the timeline of life forms. From the Timeline of Life, the children move on to the Timeline of Humans, then to the study of great civilizations. The many contributions made by early civilizations are emphasized. The study of one's own nation is one of the last subjects approached (Montessori, 1948, 1973, p. 82).

In this sequence of history studies, the child may readily see the many gifts from earlier cultures. The study of the native land is set in a context of the big picture, giving it a relative importance to all that preceded it. This Montessori approach seems to diminish the sense of nationalism that traditional methods encourage when they stress one's own nation first and above all other historical studies.

Just as everything in the Universe is connected, so does each element find its own role, or *cosmic task* to play in the cosmic scheme. Briggs and Peat offer that ...

Other animals have discovered their particular evolutionary niche. Our human trick is to have no single trick, but to live within the gaps and explore many different kinds of environmental spaces. Rather than being the king of the jungle, we are the adepts of chaos. (1999, p. 97)

Fractals

Fractals are patterns that emerge out of chaos. It is possible to see them everywhere in the Universe. In fact, fractals are the epitome of the saying “As above, so below” (Briggs & Peat, 1999, p. 148). There seem to be patterns in the Cosmos that are repeated in instances both enormous and miniscule.



Figure 1. Grand Canyon.



Figure 2. Chambered nautilus.

“Fractal” is the name given by scientists to the patterns of chaos that we see in the heavens, feel on earth, and find in the very veins and nerves of our bodies. The word was coined by the mathematician Benoit Mandelbrot and now has wide use in chaos theory, where fractals refer to the tracks, marks and forms made by the action of chaotic dynamical systems. (Briggs & Peat, 1999, p. 100)

One of the concepts that Mandelbrot explored was measuring the length of Britain's coastline. He used several types of maps for this project. With each newer, more detailed map, Mandelbrot needed to revise his figures. The more refined the map, the longer the total length became. He concluded that with each refinement in mapping, getting down to more and more details, the length would increase. Grains of sand might even be considered, or smaller, perhaps even molecules. The total, he concluded, could never be definitively computed; it would keep growing in length with every new consideration. What was his final conclusion? Mandelbrot determined "...that the coastline of Britain must be infinite." He eventually concluded "...that every coastline, from the smallest desert island to the Americas themselves, has the length of infinity" (Briggs & Peat, 1999, p. 102). His discovery is reminiscent of William Blake's poem, "Auguries of Innocence": "to see the world in a grain of sand, and eternity in an hour" (Briggs & Peat, p. 103).

Fractals are one way of seeing the expanding Universe. As it expands and expands, its "fingers" keep reaching out in its own image. We humans appear to be one expression of the Universe in its unending expansion. Our thoughts, our deeds, our children and our children's children are infinite extensions of the Universe, giving rise to more fractal expansions.

Fractals can be produced mathematically in addition to those that exist in the natural world. These artificial fractals can be stunning, but they do not seem to have the same lyrical beauty as the creations of nature. The mathematical productions are extremely regular, and seemingly too monotonous.

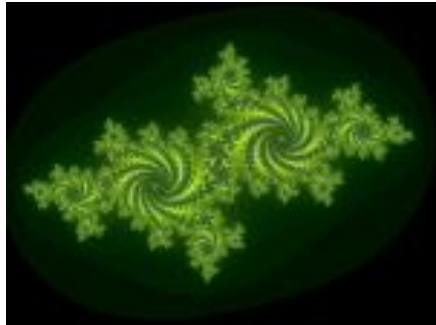


Figure 3. Mathematical fractal.

Mathematical fractals are impressive, but after repeated viewing, the freshness of one of these objects fades. This doesn't happen with the creations of nature, which emerge out of a holistic chaotic process whereby countless "parts" are subtly interconnected—true chaos as opposed to a mathematical simulation produced by repeating an algorithm. Consequently, natural fractals have an individuality, spontaneity, depth, and quality of mystery that no algorithm—even a nonlinear one—can reproduce. (Briggs & Peat, 1999, pp. 117-118)

Louv discusses the soothing effects of nature's fractal beauty on the human psyche. He quotes Lauren Haring, a 20-yr-old student:

"I really believe that there is something about nature—that when you are in it, it makes you realize that there are far larger things at work than yourself. This helps to put problems in perspective. And it is the only place where the issues facing me do not need immediate attention or resolution. Being in nature can be a way to escape without fully leaving the world." (2008, p. 52)

Indeed it appears there are far larger elements at work than ourselves. For many of us, nature can be an escape from the human world of problems and stress. And yet, it seems to me that it really is not an "escape." An escape, perhaps, from the mundane requirements of the workaday world and its attendant stresses, yes. But in fact, time spent in nature seems to make us feel more *re-connected* than ever to the "big picture," because we are *ourselves* the Universe's extensions and, therefore, inevitably connected to everything. Muir put it so aptly when he wrote:

Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves. (1901, p. 56)

Rather than actually escaping, we humans *rejoin* the Universe when we have natural experiences. It is comforting to feel our connection to the whole and time in Nature allows us that valuable opportunity.

Swimme expresses this beauty so poetically and captures the concept of fractals at work in the Universe:

There's a profound wisdom at work in the universe.... We're just beginning to understand some of the dynamics of galaxies. And to think that they actually have intrinsically the intelligence or the ordering power to bring forth all of this elegance. And so the galaxies themselves, they organize all of the material and give birth to new stars and when scientists really began to look at the galaxies this way they realized they were something like a living cell. (Rogin, 2006)

Montessori concurs and goes on to explain that when the child begins to comprehend the intelligence of the Universe:

The child's mind will then no longer wander, but becomes fixed and can work. The knowledge he then acquires is organized and systematic, his intelligence becomes whole and complete because of the vision of the whole that has been presented to him, and his interest spreads to all, for all are linked and have their place in the universe on which his mind is centred. The stars, earth, stones, life of all kinds form a whole in relation with each other, and so close is this relation that we cannot understand a stone without some understanding of the great sun, we cannot explain it without knowledge of the wide universe. (1948, 1973, p. 9)

Living within Time

Time in our modern world has become our captor.... In other societies, time is an energy of the Universe, a river to be navigated, a bosom on which to find rest. In our postindustrial world, time has become mechanical, impersonal, external, and disconnected from our inner experience. (Briggs & Peat, 1999, p. 125)

Nowhere does time seem more impersonal than in the workaday schedule of clocking in and out. Certainly, that routine can often feel like our captor. I have seen and felt the effects on myself and on others who experience that “captivity.” I wonder if young children who enter into the institutionalized world of clocking in and out for childcare also demonstrate what mechanical time does to the human soul?

One can bear witness to the emotions of young children once they, too, enter into a mechanical existence. I have seen their difficulty in adjusting to a set routine of primary school and day care afterwards. There seems to be disappointment in their faces and their postures, when they realize neither Mom nor Dad will be picking them up after a morning in primary school, and it will be another measured--but seemingly endless—period of waiting to go home to their families, pets, yards and tree houses. Is this the shock of joining the “real world?” I feel for their loss of sweet innocence when the reality sinks in that this is how it is going to be.

This “time as captor” phenomenon seems most prevalent in the industrialized world. The shortage of free time in families’ lives due to work and school routines is a factor that prevents children from spending time outdoors. Unlike the lives of children just a couple of generations ago, children today do not have the same opportunities to connect with nature in unstructured playtime. Not only have work and school schedules increased in duration, but there are more structured after-school activities for children to prevent them from having free time outside. Compounding these limitations are relatively new physical restraints, such as an increased population, smaller backyards, less wilderness, and homeowner associations that dictate how members’ properties and open spaces can be used. It seems that natural play has been “criminalized” in the last generation or two. The resulting “nature-deficit disorder” has been experienced worldwide (Louv, 2008).

Time is like a river. At any moment, a place in the stream is both the same and different. It is the same river, of course, by name. But by content, it changes from second to second.

So this stream is another metaphor for ourselves. Like the stream, our physical bodies are constantly being renewed and transformed as cells are regularly replaced. Meanwhile, the “self” that we believe lies within the body at our psychological center is also in flux. We are both the “same” person we were ten years ago and a substantially *new* person. (Briggs & Peat, 1999, p. 4)

Briggs and Peat assure us, “However, chaos theory shows that it is possible to reconnect ourselves with the living pulse of time” (1999, p. 125).

How can one fully be “in the moment?” Through meditation, many believe it is possible to fully enter into the present moment. In doing so, “...the monk touches eternity” (Briggs & Peat, 1999, p. 126). Often, those who have experienced a moment of great danger, such as in an accident, can describe how time seemed to stand still, and unfold in slow motion. Briggs & Peat call this “fractal time” (1999, p. 127). Again, I return to William Blake’s poetic notion of “eternity in an hour.”

Montessori recommends that the child’s school day remain unstructured time wise. Gang explains that the “three hour work period” is a standard of the classroom, allowing for the freedom of exploration and concentration on projects of the child’s own choosing. Without the intrusion of scheduled activities, the children may become absorbed in the work of self-creation, following where their sensitive periods lead them. The fragmented schedule of the traditional educational approach is to be avoided if educators are to encourage the children to follow their own rhythms and inclinations (Gang, 2014, January 5).

Everything from atom to cell, from tree to cosmos, carries its own internal clock that measures its individual passage of time, which is to say, the amount of process it has

experienced.... Time's rhythms range from the fast ticking of the atom to the expansion of the entire cosmos. (Briggs & Peat, 1999, p. 133)

Music is another measure of time. However, even the rhythms of music are slightly irregular. Just like fractals, natural musical rhythms are not mechanically uniform. Uniform beats seem unnatural to the ear and are less pleasing than those with slight irregularity. Cardiologists have discovered that even healthy heartbeats naturally have minor fluctuations. Only unhealthy hearts are mechanically regular in their beating, which is a sign of disease (Briggs & Peat, 1999).

Rejoining the Whole

Over time, we humans seem to have come to see ourselves as separate from the Cosmos. Our "separation" has led us to see, or wish to see, ourselves as in control of nature, rather than as a part of it. It has been a long journey from humankind's earliest days in which our very survival depended upon our feeling *connected* to nature. In Chapter 2, I examined Gang's four ages of humanity's relationship with nature. The fourth age, the Age of Humanity through Nature brought about a major change in how humans viewed the Universe with the advent of quantum mechanics.

This is a significant paradigm shift for humanity. No longer does humankind seem to be an independent master over nature, but a part of the whole of nature, intertwined in its structures, engaged in the cosmic process that is unfolding. "Experiencing solidarity with the whole universe is about freeing ourselves from the chronic habit of thinking that we're just disconnected fragments.... It is about using our subtle influence to become participators of the blue planet rather than its managers" (Briggs & Peat, 1999, pp. 164-165).

In a stroke of irony, it has been humankind's very technological advances themselves that have afforded us some of the opportunities to see and to understand our connections with the

Universe. Were it not for quantum physics and space exploration, these revelations might not have been discovered. For example, astronauts have commented on the awe-inspiring sentiments that viewing planet Earth from orbit has evoked in them. Astronaut Edgar Mitchell expresses the ineffable upon seeing planet Earth from space, a vantage point that only a rare few have had:

[It was] "...a glimpse of divinity.... [T]here was a purposefulness of cosmos—that was beyond man's rational ability to understand, that suddenly there was a non-rational way of understanding that had been beyond my previous experience.... [G]azing through 240,000 miles of space toward the stars and the planet from which I had come, I suddenly experienced the Universe as intelligent, loving, harmonious." (Briggs & Peat, 1999, p. 143)

It was aerospace technology, one of humankind's most *mechanical* inventions, that allowed Mitchell his "aha" moment of illumination. Can one be any more separated from nature than to be lifted off planet Earth by rocket boosters and thrust into space? Still, it was this very unnatural experience that allowed Mitchell to see the "big picture," to get in touch with his inner truth and sense that "glimpse of divinity."

Henry David Thoreau, the American author, poet, and philosopher, warned us more than a century ago, "Lo! Men have become tools of their tools" (Briggs & Peat, 1999, p. 153). True enough, it seems. Our dependence on our machines has proven to be a double-edged sword--on the one hand enabling us to make discoveries of epic proportions, on the other hand, overwhelming the planet with our materialism and unsustainably increasing demands for energy and resources. However, we may need our tools to overcome the ecological crisis that our Earth faces in light of humankind's impact on it. New, green technologies such as wind, geothermal, and solar power just might hold the answer to remedying the climate changes that challenge humanity to think anew.

Conclusion

The seven lessons of chaos may create a new and valuable paradigm for understanding humankind's place in the Universe. Understanding chaos requires a return to the beginning of time, the origin of everything. Confronted with that creative vortex of energy, one might see how all is connected, that out of one tiny dot, smaller than a grain of sand, everything unfolded. "All of space and time and mass and energy began as a single point that was trillions of degrees hot and that instantly rushed apart" (Swimme & Tucker, 2011, pp. 5-6).



Figure 4. "Our Planet, Our Home" (Gang & Morgan, 1988): All elements of the Universe are shown united as one single point about to rush apart. This arrangement was created by the participants in the group activity completed in Santa Barbara, CA, November, 2013.

Everything was present in that very moment, even humanity. We have a birth pedigree on the same level of stars...and so does everything else in this autopoietic Universe.

It may be easy to be overwhelmed by the vastness of the Cosmos. Looking up into the night sky at the seemingly infinite number of stars, we each appear quite small. But we are also part of that incomprehensible wholeness as well. We each play a part in the Universe with our cosmic task driving us. The butterfly effect reassures us that what we do, no matter how small it seems, does make a difference. So *it is* most important that we do it.

The third lesson affirms that coevolution and cooperation, not competition, have allowed the unfolding Universe to evolve. For example, our planet depends upon our star, the Sun, to hold us in its gravitational pull, to provide light and energy for us. Life forms have become interdependent upon one another for survival on the planet, often cooperating in symbiotic relationships for mutual success. As plants and animals each perform their cosmic tasks, they benefit not only themselves, but also the ecosystems in which they participate.

Next, the paradox of the simple and the complex reminds us that both exist side by side, like two points on a circle, on opposite sides of a spectrum of light and dark. In the simplest organism, such as a bacterium, there is a complexity that would take many lifetimes to understand. On the other hand, even the most complex ecosystems on Earth arose from one single point the size of a grain of sand.

In lesson five I examined the concept of fractals, present everywhere in the unfolding patterns of the Universe. As the Universe continues its expansion, patterns repeat and repeat, extending infinitely like fingers upon fingers of hands and hands. Although humans have learned how to employ mathematics to create fractal patterns, those that exist in nature embody a beauty and harmony that artificial fractals cannot duplicate.

Living within time has become a challenge of our age. Lesson six was about how industrial society has mechanized time, allowing time to imprison us. However, we could re-learn how to view time as an energy, as it was in the primordial beginning of the Universe. In so doing, we could free the human spirit of the bonds we have allowed to enchain us.

The seventh lesson, rejoining the whole, encourages us to recall where and how we originated. Swimme states in an interview,

Our industrial society has created a form of education that trains us to focus on the secondary things, like materialism. We have to free ourselves and unlearn the ideology of consumerism, materialism. Instead, people can become fascinated with nature, the Universe, life. A natural tendency of humans is to fall in love with the Universe, with existence. The Universe story is a powerful attractor. (2003)

These lessons have helped me to integrate my thinking and my being, first as a person and also as an educator. It seems that now--in this time of global environmental crises—it helps to understand the seven lessons of chaos and “to fall in love with the Universe.” Everything that is known (and even that which is unknown) unfolded out of the original chaos that we call the Universe. All of the needed answers to humanity’s questions are already waiting for us to discover them. In that tiny point, we were present billions of years ago, awaiting our eventual emergence as a fractal, expanding the definition of the Universe. It appears then, that we are powerful and filled with the Universe’s infinite potential, because in fact we *are*—each of us--the Universe acting.

Chapter 8: Autopoiesis and Reciprocity – The Cosmic Dance

What Is Autopoiesis?

To begin to define autopoiesis, a term coined in 1972 by Chilean biologists, Humberto Maturana and Francisco Varela, I will break it down into its Greek roots: *αυτο* – self, and *ποιησις* – creation, or “self-creation.”

Maturana and Varela sought to identify what defines all living beings: What are those fundamental characteristics that define them all as “living” despite their diversity as members of different species? What they found “...was the evidence of a unitary nature, a coherent wholeness, an *autonomy* that is ‘brought forth’ by the system itself” (Rudrauf, Lutz, Cosmelli, Lachaux, & Le Van Quyen, 2003, p. 1).

Here is yet another definition for the lay reader:

Autopoiesis refers to self-producing, self-maintaining, self-repairing, and self-relational aspects of living systems. Living beings maintain their form by the continuous interchange and flow of chemical components. Cellular autopoietic systems are bounded by a dynamic material made by the system itself. (“Autopoiesis,” n.d.)

Humberto Mariotti, a psychiatrist, psychotherapist, and the coordinator of the Studies Group of Complexity and Systems Thinking of the Palas Athena Association, in São Paulo, Brazil, summarizes Maturana and Varela’s theories succinctly. “...Living systems need to obtain resources from the environment in which they live. In other words, they are simultaneously autonomic and dependent systems” (1996, p. 1). This paradox cannot be understood by traditional linear thinking. Maturana and Varela used a metaphor to explain living systems: they are “self-producing machines.” No other machine is capable of doing this. “Since autopoietic systems are simultaneously producers and products, it could also be said that they are circular

systems” (Mariotti, 1996, pp. 1-2).

Varela, Maturana’s student at the University of Chile, was a “...master of synthesis.... He was highly instrumental in shaping modern systems theory as well as cognitive science.... Varela spent his life building bridges: between Western science and Eastern wisdom, neurobiology and philosophy, abstract theory and practical life” (Bernhard Porksen, Professor of Communication Science, University of Hamburg) (Reichle, 2005).

Varela explained, “We have to distinguish between knowledge and wisdom. Science is a form of knowledge; art is another form of knowledge; magic is another form of knowledge.... There is only *one* wisdom, on the other hand...which is based on love” (Reichle, 2005). Varela goes on to explain that in autopoiesis, there is a cosmic dance of co-creation.

We are free to understand that this world is...our own dance together.... Whatever we do *changes* what the world is like.... The bee dreams up the flower and the flower dreams up the bee. Bee and flower are together in a way that if you take one out, the other disappears. (Reichle, 2005)

Antoine Lutz, an associate scientist at Waisman Laboratory for Brain Imaging & Behavior at the University of Wisconsin-Madison, clarifies how the *interdependence* between beings, previously thought of as a subject and object (known in Varela’s work as “structural coupling” and as reciprocity) manifests and he explains why one needs a new method of observation.

It is wrong to presuppose that there exists an objective world independent of the observer.... In visual perception the observer’s place is essential...and thus that the world which may seem objective to us, is not independent of the observer perceiving it. And so this whole difficulty...has been Francisco’s entire research program. It consisted in

understanding the flow between this, “objective world” and the world of the individual and world of experience lived by an individual. (Reichle, 2005)

The paradox of autopoiesis compels one to consider how intertwined all living beings are with the environment. If we are self-constructing, our environment influences that construction of self; the constructed self affects the environment through choices and actions, thereby influencing the future environment that will in turn act upon the autopoietic individual. This feedback loop seems to have no beginning, no end.

Our personal perceptions of the world are *structural* in their nature according to Varela. *Structure* is individual. There are, therefore, many different perceptions of the world—as many as there are individuals, resulting in a multitude of different realities. “This explains why the so-called purely objective knowledge is impossible: the observer is not apart from the phenomena he or she observes” (Mariotti, 1996, p. 4). Therefore, there cannot be any “objective” observation.

Those who claim to be objective in their perceptions would seem to be in error. Objectivity appears impossible. Truth is elusive. It is not possible to “...arrive to the truth and show it to our peers — a truth that we imagine that is the same for everybody” (Mariotti, 1996, p. 5). I have seen this repeatedly in my experiences; truth seems subjective. For example, this subjectivity surfaces in relationships and can be seen in discussions of politics, in policies adopted by institutions such as public school districts, and in interpersonal exchanges of all kinds, such as parent-teacher conferences. What may look like a solid fact to one person may appear false to another. It is very difficult to uncover an absolute truth.

Accepting that is helpful in our work with children and their parents. As individuals, we each hold certain personal perceptions to be truths and we tend to operate as if everyone else does as well. Acknowledging that we live in subjectivity, rather than objectivity, allows us a better understanding of the world in which we live and creates a bridge of empathy with others as we all search for meaning in life. Gang shared this example of Maturana and Varela's perspective on the biological foundation of cognition and knowledge:

A cell consists of a number of parts including a nucleus, the DNA and a membrane. The membrane is semi-permeable which enables the cell to develop a relationship with the environment. As a result, the cell changes, grows and develops. Cognition, according to Maturana and Varela, can be characterised as an effective action which enables a living system to exist in a certain environment, thus creating its own world. If we want to give children the opportunity to exist in a certain environment (today's world), we need to give them the safe space in which to develop a relationship with the environment and allow them to create their own world, a world with greater meaning and sustainability. (2014 November 03, 1:239)

It is helpful to continue to view the process of autopoiesis as characterized by a certain permeability between the interacting elements. There is an exchange between the participants; it is a reciprocating, two-way street, so to speak. Nichols also addresses that permeability:

It's easy to forget that the body is composed of the same atoms that make up the world that surrounds it, and that we are exchanging molecules with every inhale and exhale, every morsel of food, and every skin cell that sloughs off as a new one appears. By cutting ourselves off from the awareness of our interdependence with everything that is not man-made, we sever ourselves from the incredible beauty of what our senses actually are taking in. (2014, location 1444)

Briggs and Peat note that chaos is self-organizing and creative. In agreement with Varela, they recognize the reciprocity in the relationship between our environments and our *selves*. "Our

attitude and being forms [sic] the climate others live in, the atmosphere they breathe.” (1999, p. 41).

Chapter 7 illustrated how evolution is full of examples of coevolution and cooperation. This reciprocity, or symbiosis, in nature has great potential for creation. Lynn Margulis, a professor of cell biology at the University of Massachusetts, Amherst, explains, “Chaotic creativity suggests why diversity is so important. When diverse individuals come together, they have a tremendous creative potential.” (Briggs & Peat, 1999, p. 67). For example, when one bacterium invaded another millions of years ago, the host cell acquired the ability to breathe oxygen and the invading cell acquired a home environment. This symbiosis would evolve over time and eventually lead to the “...kinds of cells we have in our own bodies” (Briggs & Peat, 1999, p. 67).

It seems that humanity in general--and many of us as individuals--have mistakenly come to see ourselves as separate from the Cosmos. Our perceived “separation” has led us to see, or wish to see, ourselves as in control of nature, rather than as a part of it. Instead humankind may be better served by seeking unity--oneness—with the Cosmos.

Federman (7:8) stated in the Fall 2014 eCampus Integrative Seminar on Creativity and Research, "Varela says it best: 'one wisdom, based on love'" (Reichle, 2005). The question that occurs to me is, how do we *discover* that *one* wisdom? The clue as to the answer follows in the words "*based on love*." Love for others, love of the environment, love of the Universe, love also of self. That is a powerfully inspirational message.

I personally felt autopoiesis, structural coupling, and love actively at work when I took my kindergartners to our garden plot to weed, to harvest the scallions that they had planted, and

to plant iris bulbs. Each student has a small plot in our raised bed—roughly two square feet per child with a chrysanthemum and scallions for each, and lavender plants in between their squares.

The weather was gloriously pleasant and the sensation of having our hands in the soft, damp earth was deeply satisfying. The digging quickly produced several healthy earthworm specimens and the children were delighted. We had learned about worms and their beneficial work earlier this school year as well as a new song about them. Immediately the group of eight children and I burst into the worm song “Wiggly Woo” as we went about our work, naming each earthworm as we sang.

Amy Cohen Varela, the widow of Varela, related that he explained to her, “Ideas aren’t anybody’s. They are floating around...and somebody grabs one and thematizes or develops it. Independent groups can come up with the same idea because it’s in the air. They’re not something that one person possesses and gives to someone else...” (Reichle, 2005).

Where did the idea for the song originate? The warm feelings of fascination with nature, respect for life, the oneness of singing together outdoors on a beautiful day, and the love for the earthworms they were cradling in their hands...I could literally *feel* autopoiesis, structural coupling, and love at work. The connection that I felt with the children was palpable.

When I think about it, it reminds me of Dr. Seuss’s story of the Grinch when his heart grew several sizes. Everyone in my class, including myself (I hope), is much kinder than the Grinch. But I felt our hearts growing in size together that day and I was awed by the shared experiences and the power of the love in the garden.

Gang (2014) cites a lecture that clarified these concepts: “Your postings remind me of the lecture we had at Bergamo in 1973. The lecture concludes with this statement from Montessori.”

Each expression of everything that exists has a cosmic sense, and the union of these cosmic finalities not only maintains the level of life, but increases it. Each being answers a special call that is beyond comprehension but which renders everything a participant of creation. (2014, October 7:35)

Indeed, it seems that as participants of creation, we each affect the others whom we encounter in our daily lives. Every one of us probably knows someone who always seems to have a smile on their face, embodying happiness, and making us, in turn, content to be around them. Their happiness in turn has a “butterfly effect,” radiating outward like the ripples on a pond.

Research shows that the amount of happiness we experience spreads outward, affecting not just the people we know but also the friends of their friends as well (or three degrees of the famous six degrees of separation). Happy people demonstrate better cognition and attention, make better decisions, take better care of themselves, and are better friends, parents, and citizens. (Nichols, 2014, location 311).

Abram uses this beautiful example of a natural experience to illustrate reciprocity:

Wander over to that oak, or to a maple, or a sycamore; reach out your hand to feel the surface of a single, many-pointed leaf between our thumb and fingers. Note the coolness of that leaf against your skin, the veined texture your fingertips discover as they roam across it. But notice, too, another slightly different sensation: that you are also being touched *by* the tree. That the leaf itself is gently exploring your fingers, its pores sampling the chemistry of your skin, feeling the smooth and bulging texture of your thumb even as the thumb moves upon it.

As soon as we acknowledge that our hands are included within the tactile world, we are forced to notice this reciprocity: whenever we touch any entity, we are also ourselves being touched *by* that entity.

Such reciprocity is the very structure of perception. We experience the sensuous world only by rendering ourselves vulnerable to that world. Sensory perception is this ongoing interweavement: the terrain enters into us only to the extent that we allow ourselves to be taken up *within* that terrain” (2003, p. 58).

In the Integrative Seminar on Creativity and Research in October, 2014, Nanayakkara stated (7:122)

[Philip] mentioned in (7:119) that “the nature of love permeates our thinking.” How true this has been for me.... Although at times I may be overwhelmed or nervous, this specific seminar has shown me, that I, along with my students, benefit the most when I embody peace and love. Like the concept of structural coupling, I can see how systems of networks (in my case: staff and student community) enter in a circulatory dance of dialogue and constant engagement, reminding me that one does not benefit unless the other does as well. (October 2014)

This unifying idea of “community” guides us as we go forward. “Humans discovered that the universe as a whole is not simply a background, not simply an existing place; the universe itself is a developing community of beings” (Swimme & Berry, 1992, p. 14).

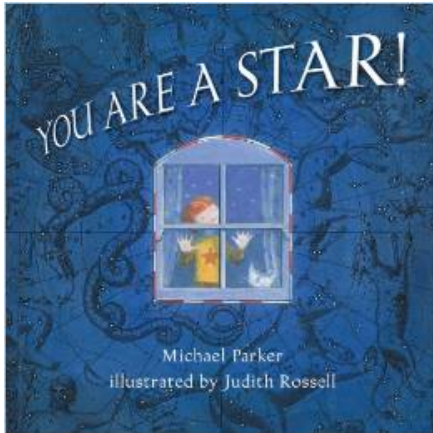


Figure 5. Cover of *YOU ARE A STAR!* (reproduced with permission from the publisher).

***YOU ARE A STAR!* by Michael Parker, illustrated by Judith Rossell**

The lesson that I chose for my research is based upon a short, illustrated children's book, *YOU ARE A STAR!*, written by Michael Parker and illustrated by Judith Rossell. (Text copyright ©2012 by Michael Parker. Illustrations copyright ©Judith Rossell. Published by Walker Children's Books.) I teach in a primary classroom of 28 children at a public Montessori magnet school within the Denver Public Schools. I use this book in my classroom with the kindergarten students every year as we are about to begin lessons on the Universe, constellations, our Sun and solar system.

The purpose of this research method is to examine both the observed and the observer. "Neurophenomenology," an approach to observation, operates on the assumption that each has an effect on the other. There is no one objective point of view that serves as the truth for all participants; each participant has a unique experience and in doing so, influences the experiences of the others. These shared influences are termed "structural coupling" or "reciprocity."

I chose the afternoon of November 17, 2014, for this lesson. The nine kindergartners who participated had just returned from two "specials" classes with other teachers in our building.

Before they entered our classroom, I advised them that there would be a couple of cameras in the room and that I would be taking pictures of our lesson so that they would not be unduly distracted by the cameras. Additionally, I laid out woven mats that we use for sitting, spacing them in such a way that I hoped would capture all of the children in the video. I also arranged the children so that those who are smaller and shorter were in the front and taller students were in the back. The text of the book to follow will be indicated in italics. Pseudonyms are used instead of the actual names of the students. The duration of the lesson, from the sharing of the book through the questions and reactions, was approximately fifteen minutes.

Third Person Observation - Entire Group of Children

All of the children are sitting up on their mats, facing the teacher, eyes on the book or teacher at the beginning of the lesson. When the teacher reads the title, *YOU ARE A STAR!*, most of the children exclaim in reaction, “Ohh!” Thomas responds to the author’s name, Michael Parker, by saying softly, “Hey, I have a friend named Michael.” When the group is quieter, he repeats more loudly, smiling, “Hey, I have a friend called Michael. It’s one of our neighbors.” Two of the children turn to look at him.

The teacher begins to read, “*You are a star.*”

Thomas interjects, “I’m a star, too!”

Then Alex chimes in, “I’m a star, too!” and he raises both arms, gesticulating with his hands above his head.

Then the teacher clarifies from the book, “*Not a movie star...*” and both boys quiet down.

Alex slumps and interjects, disappointedly, “Ohh.”

The teacher continues, “...or a sports star...” and Alex brightens and raises his head with a big grin, saying, “Yeah?!” In the meantime, the other children are watching the teacher and listening, with the exception of Teresa, who glances at Alex’s reactions.

The teacher reads, “*You are a star from way, way up in the sky!*”

Thomas responds with, “Yaaay!” and four other children join in with him.

Then Teresa comments, “Hey, look! That’s the word on my shirt.” Indeed, “YAY!” is printed on the front of her t-shirt. Thomas twists and turns toward her to read the word as she looks down at her t-shirt.

“*Look at the tip of your finger, just there.*” The teacher gestures and in imitation, all of the children look at one of their own fingers in front of them in unison.

Ramona remarks, as she leans over toward Thomas, “It’s so cuuute!”

The teacher continues, “*Look at all the tiny grooves and curves...*” Three children are still looking at their fingers. Teresa is wrapping her sweater around herself. Guillermo is looking at the book. Kayla is nearly pointing her finger into her left eye. Alex is looking across the group at the others.

“*Every little bit of that finger comes from way, way up in the sky. Come and see....*” Four children look at their fingertips again and at the book.

Thomas starts to say, “How does it...?”

The teacher reads, “*Up, past your bed...past your window...past your roof.*” Alex is looking at the other children in the group. All of the other children are looking at the book or the

teacher. “*Up, into the ink of the night.*” Guillermo looks down, Teresa brushes her hair out of her eyes, and Alex turns his attention back to the book.

Ramona remarks, “I knew this book for a very long time.”

Teresa agrees, “Yes, me, too!”

“*It may be dark out here, but the sky is not all empty and black.*” Guillermo has both hands around his shirt collar, which is pushed up into his mouth while he’s watching. Kayla and Vincent also have their hands in their mouths while watching. Ramona raises a hand to her mouth while leaning to her right. Alex moves off his mat and off screen.

The teacher reads, “*Look! More stars than you can count...on all your fingers, and all your toes!*” Leon responds with an open mouth; Teresa looks down in amazement; Thomas holds both hands in front of him as if to count his fingers; Guillermo removes his shirt from his mouth; and Ramona removes her hand from her mouth; Vincent and Kayla continue to look forward with hands in their mouths. Both the eyes and the heads in the group are raised up. Alex returns to his place on the mat.

The teacher emphasizes from the book, “*Hundreds of stars...thousands!*”

Someone in the group affirms, “Hmm hmm!” Ramona and Alex rock back and forth while repeating, “Thousands!” Kayla rubs her finger back and forth in her mouth as if she were brushing her teeth.

Guillermo predicts the next word on the next page with “Millions!” and then the teacher turns the page and reads, “*Millions!*” Guillermo smiles; Teresa, Thomas, and Vincent smile too. Ramona says, “Mmmmmm!”

The teacher asks, "Do you know how much a million is?"

Ramona raises her hand and starts to say, "I know..." while the teacher explains, "A thousand thousands!"

All children's eyes, with the exception of Thomas's, are on the teacher or book at this point. Guillermo repeats, "A thousand thousands?" Now everyone's eyes are intently on the teacher.

Teacher, "Imagine the thousand chain, and you know where every bead is on the thousand chain? Instead of it being *one bead* it would be a *thousand cube*." Alex moves off his mat, off screen. All the other children are looking intently at the teacher, four of them with their mouths wide open. Sonya and Thomas tip their heads; Teresa glances at Thomas with her eyes wide open and a smile on her face, murmuring something unintelligible to Thomas as the teacher explains, "...And then if you stretch it out, it would be a thousand times as long."

"Just lie here for a moment with all the stars above you and all the Earth below you."

Guillermo raises his eyebrows up and down a couple of times and interjects, smiling slightly, "Affinity" [sic "infinity"]. Alex kneels upon his mat, back on screen, looking at the book. Thomas looks at the camera; other children look intently at the book. Vincent and Kayla both have their hands in their mouths. Ramona is pulling on her right ear.

Reading, "*Those stars over there are fires in the sky. Giant fires a long, long way away. Much, much hotter than a candle's light, much, much farther than our Sun.*" Four of the children have their hands up around their chins, looking pensively at the book. The teacher reads, "*Let's have a closer look.*" Thomas repeats the teacher's last line. Alex is doing a back bridge. The

other children's eyes are on the book.

The teacher reads, "*A long, long time ago, this star got hotter....*" Ramona leans toward Thomas and mutters something unintelligible. Reading, "*...hotter and hotter....*"

Guillermo interjects, "That's the Sun," while smiling. Alex is looking at the book intently. The teacher continues, "*Can you feel the heat yet?*"

Ramona and Alex respond, "No!"

"Hotter and hotter and hotter..."

Guillermo interjects again, "That's the Sun!" Alex's eyes are on the book, wide open.

Vincent repeats, "That's the *Sun!*" Ramona yawns.

The teacher exclaims, "*...until it exploded!*" All eyes are on the book. Four children have their chins in their hands. The teacher continues, "*Are you okay? Yes?*"

Teresa responds, "Yes," while several children nod their heads in agreement.

Thomas answers, "The star exploded!"

Alex added, "No, I'm dead! Ohh!!" Vincent and Teresa laugh.

"When the star exploded, the tiny pieces flew across the sky...." All eyes are on the book. *"...Like lonely little boats. Look at those tiny ones lit up brighter than the rest."* Alex is crouching on his mat, leaning forward. The teacher reads, "*There they are flying across space for millions and billions of years.*"

Alex reacts, speaking over the lines of the book, "All of them look like pirate...like

pirate...boats....”

“Through the cold and the dark and the emptiness, looking for a home.”

Thomas adds, saying about the child character in the book, “He becomes a star.”

“Until finally they come to rest in the place that will be Earth. And the place that will be Earth tumbles and turns with our tiny pieces of star inside.”

Thomas continues, “He turns into the star.”

“Look! Earth is getting greener and cooler and more beautiful as it turns.” Ramona yawns with her eyes on the book. All other eyes are on the book with the exception of Alex who is looking down.

Thomas persists, “He’s going to turn into the star.”

Teresa responds with a puzzled expression and shakes her head, “No.”

“And the tiny pieces of star sail through rocks and plants and fires....”

Guillermo points to the pictures in the book saying, “Those are dinosaurs!”

Leon adds, “Yeah!”

Alex has moved off screen, but still repeats, “Those are dinosaurs! I see a flying dinosaur.”

She reads, *“...through animals and trees...and fruit, until...”*

Thomas anticipates, “He becomes it!”

The teacher continues reading, "...*you eat the fruit.*"

Alex has rolled up his woven mat. Ramona says, "Ms. Linda,"

"...*until the tiny pieces of star are...*"

Guillermo interjects, "...inside you!"

The teacher finishes, "...*inside you!*"

Thomas says to Teresa, "I told you. See, he becomes a star."

"*Sailing down through your mouth, your tummy, your arm...almost there until the tiny...*"

Ramona points to Alex who is rolling his mat between his hands, "Ms. Linda..."

"... *pieces of star are at the tip of your finger in amongst the grooves and curves...*"

Ramona yawns, Teresa and Thomas look at their fingertips, and Vincent has his hands in his mouth while looking up. Teacher continues reading, "...*waving back at you.*"

Ramona points at Alex saying to the teacher, "Alex, Alex took off his mat. You're supposed to sit on it."

"*It's time to return to your room, snuggle back into bed, but remember, that sky way, way above your bed is not dark and cold. It is the cradle from which you came. You are ...*"

Guillermo and Teresa chime in, "...*a star!*"

Thomas cheers, "Yayyyy!" pointing to the "YAY!" on Teresa's t-shirt again. Kayla does a back roll. Vincent and Ramona mimic little applauses.

The teacher opens the discussion with, "I want to ask you if you have any questions or

comments about the book?" Kayla returns to upright from her back roll and shoots up her hand along with Guillermo. "Stay seated please," says the teacher as Alex and Ramona start to move as if to leave.

Ramona responds, "Aww."

The teacher says, "Leon, I think you have a question."

Leon nods his head and asks, "Umm...why...why did that...she float up into the sky?"

Teresa says, "It's a he."

The teacher replies, "You know what? I find it interesting that in this book the child kind of looks like a boy *or* a girl. I can't tell if it's a boy or a girl."

Thomas replies, "A boy."

Ramona kneels on her mat and raises her hand, "A girl! Who else thinks it's a girl?"

The teacher continues, "Who else has a question?"

Kayla and Ramona raise their hands.

The teacher calls upon Kayla.

Kayla, gesticulating in the air, asks, "How does the boy or girl float up in the air? How does it fly?"

The teacher replies, "Oh, well when we get to that part of the book about the child floating to the sky, what do you think the author is asking us to use...in that part of the book?"

Ramona's hand goes up. Vincent purses his lips together intently. He interjects, quietly,

“Imagination?” smiling and looking at the teacher.

The teacher persists, “What did you say, Vincent?”

Vincent answers more boldly, “Imagination.”

The teacher agrees, “Imagination. Right, I believe we’re to use our imaginations. What if we *could* fly up into the night?”

Ramona inquires, incredulously, “For real?”

The teacher asks, “What if we could? Imagine what that would be like.”

There are general reactions amongst the children, and a few quizzical looks. Ramona closes her eyes and squints with her fingers against her temples as if she is imagining, and there is a bit of murmuring (unintelligible).

Thomas gets up on his mat and jumps up as if he is taking off into the sky. Upon his landing he bumps Ramona who responds, “Ow, Thomas kicked me.” The teacher reminds the children that the mats are for sitting.

Guillermo has a question. “How does the boy or a girl be a star?”

Alex also gets up on his feet, jumps off his mat, then points to Thomas who started it, smiling sheepishly when the teacher gives him a corrective look.

The teacher prompts them, “Oh, how is it, why does the author say that you are a star?”

Ramona replies, “Good question, Guillermo!”

There is general movement amongst the children.

The teacher returns to the book. “Remember when the star explodes? It gets hotter and hotter until finally it explodes? There’s a special name for a star that explodes. I’m going to show you that picture.”

Ramona offers, smiling, “Urstalenium!”

Vincent has his mat on his head.

Alex is turning away from the group.

The teacher, pointing to the picture in the book, explains, “This is called a supernova.”

The students become quiet and still. All eyes are on the teacher again, with the exception of Alex who is off screen. “There are stars that, on occasion, explode. And when they do, their stardust goes for millions and billions of miles through the Universe.”

Guillermo says, “Infinity beyond?”

The teacher finishes, “...including coming all the way to Earth. Yes, maybe infinity and beyond....And when that stardust comes all the way to Earth, it helps to make our planet Earth.”

Thomas and Ramona are lying on their stomachs on the floor. Ramona gasps.

The teacher continues, “Our planet Earth has stardust in it. And when you eat the plants that grow on the Earth,” nearly all eyes are on the teacher, “where does that stardust go? Well the stardust goes into the plants...and then that stardust goes into *you!*”

Chattering amongst the children, as they talk about the pictures of plants and dinosaurs on the page in the book. Teresa comments, “The flying ones are pterodactyls.” Thomas fiddles with his mat. The teacher holds it for him.

The teacher elaborates, “Everybody here, not just you, not just me, but everybody in our school, everybody across the street....” The children glance out the window as the teacher continues, “...everybody in your neighborhood, everybody in Colorado....”

Kayla interjects, “Everybody on Earth.”

The teacher adds, “...everybody in the United States, everybody in North America....”

Ramona kneels on her mat and shouts, “Everybody in Texas!”

The teacher arrives at the climax, “...*everybody on Earth...*”

Ramona exclaims, “...in Mexico!”

Vincent adds, “Even Africa!”

The teacher affirms, “Even Africa, all parts of the Earth, have stardust in them.

Teresa persists, “Even Pennsylvania?”

Ramona continues, “Even where my grandma Pita lives?”

The teacher requests, “Ramona, please bring me the globe, the colored globe that we use for our birthday celebrations.”

Vincent, “Even New York?”

The teacher confirms, “Even New York.”

There is a general clamor as children shout out states where they have relatives, chuckling amongst themselves.

The teacher adds, "It's pretty exciting when you think about it, isn't it?" The teacher collects a couple of mats that are distracting the children from the conversation. She reminds the children that the mats were to insure that they would be included in the picture.

Ramona has brought the globe. The teacher says, "Now here is our planet, Earth. When the supernova exploded, the stardust travelled through space and mixed in with the Earth..."

Guillermo adds, "All the way to North America."

The teacher emphasizes, "All the Earth got stardust in it...all of it. So everybody who lives on the Earth...Sonya, Leon, Kayla, Guillermo, Vincent, Thomas, Alex, Teresa, and Ramona...you all have stardust in you..."

Teresa, concerned that someone might have been left out, asks, "Did you say Vincent?"

"I think I did, but so does everybody else who lives on the Earth, including my dog. Stardust has stardust in her."

Teresa questions, "Does my dog have it?"

The teacher insists, "Yes, Pip has stardust in him, too!"

General clamor as children react, shouting out about their pets. Guillermo covers his ears.

The teacher concludes, "Every living being on the entire Earth has stardust."

Leon wonders, "Does my Luna cat?"

The teacher smiles, "Luna cat? Luna cat means 'Moon cat.' Luna means 'moon.' It's Latin. You know how we count in Latin?"

Collectively children start to count in Latin. There is a lot of movement among the children now. Alex has wandered away.

The teacher reminds, “Well, everyone have a seat again and we’ll count in Latin. (Together) Unus, duo, tres, quattuor, quinque, sex, septum, octo, novem, decem.” (Teacher) Luna is Latin too, and it means *moon*, so Luna Cat means ‘moon cat.’ And my dog’s name is Stardust ...and [joking] her name means ‘stardust’ because she’s made out of stardust, just like *I’m* made out of stardust and just like *you’re* all made out of stardust...” Children are intently re-engaged in the discussion again. “Just like *every* living thing on the Earth is made out of stardust.”

Thomas says, “I have stardust in my *house*.”

The teacher reacts, “You have stardust in your house?! Think, isn’t that exciting? You are made out of the same things as a star.” Ramona gasps and sighs, falling over dramatically.

Teresa asks, “Even a cat named Luna?”

The teacher affirms, “Even a cat named Luna or a dog named Pip. Even an earthworm named Wiggly Woo.”

Ramona sits up in excitement, her eyes and mouth wide open and starts singing and wiggling to the song that the children learned earlier this year about an earthworm. Spontaneously, led by Ramona and Thomas, the entire group (the teacher included), smiling, breaks into the song, “Wiggly Woo.” Thus concludes the lesson.

First Person Observation - Teacher

This is the seminal lesson for the study of the Universe, constellations, the Sun, and solar system. I look forward to sharing this book with the children each year. I view it as the foundation for cosmic education in our classroom and am curious to see how the children in each group will react.

I set up the lesson so that all of the children could sit on their mats within view of one of the camera lenses, facing forward. Meanwhile, there is a separate camera focused on me so that I can later observe myself. When I read the title, *YOU ARE A STAR!*, the children all have their eyes on the book and me. Most of the children exclaim in reaction, “Ohh!”

When Thomas responds to the author’s name, Michael Parker, by saying softly, “Hey, I have a friend named Michael,” I ignore the interjection as I wish to discourage off-topic interruptions. When the group is quieter, he repeats more loudly, smiling, “Hey, I have a friend called Michael. It’s one of our neighbors.” Two of the children turn to look at him. Again, I ignore it.

I repeat the title, *YOU ARE A STAR!*, and Thomas interjects, “I’m a star, too!”

Then Alex chimes in, “I’m a star, too!”

I expected this behavior from some children, based upon their needs and learning styles. When I read from the book, “*Not a movie star...*” both boys quiet down, Alex slumping and interjecting, disappointedly, “Ohh.” I continue, “*...or a sports star...*” hoping to engage them in the book quickly. The other children are watching me and listening.

When I read, “*You are a star from way, way up in the sky!*” Thomas responds with

“Yaaay!” and four other children join in with him.

Then Teresa comments, “Hey, look! That’s the word on my shirt.” Indeed, “YAY!” is printed on the front of her t-shirt. Thomas twists and turns toward her to read the word as she looks down at her t-shirt.

I ignore these side distractions and continue. I read, “*Look at the tip of your finger, just there,*” emphatically extending my hand with my pointer finger out. All of the children look at a finger in front of them in unison. “*Look at all the tiny grooves and curves...*” Three children are still looking at their fingers. I had hoped that these gestures would focus their attention. I am pleased that they are following along.

I continue, “*Every little bit of that finger comes from way, way up in the sky. Come and see....*” Four children look at their fingertips again and at the book.

Thomas starts to say, “How does it...?”

I raise my voice with emphasis, wishing to keep their attention on the book at this point, “*Up, past your bed...past your window...past your roof.*” Most of the other children are looking at the book or at me. “*Up, into the ink of the night.*”

Ramona remarks, “I knew this book for a very long time.”

Teresa agrees, “Yes, me, too!”

I think to myself that I have not read this book to this group of children yet, but I realize that last year one of my assistant teachers did take it off the shelf and read it to them. My intention with this book is to save it for the kindergarten year. I resolve to keep the book on my

“reserved” shelf from now on so that it will be a special occasion when I read it.

“It may be dark out here, but the sky is not all empty and black. Look! More stars than you can count...on all your fingers, and all your toes!” I notice that the children respond with interest: Leon responds with an open mouth; Teresa looks down in amazement; Thomas holds both hands in front of him as if to count his fingers; Guillermo removes his shirt from his mouth; and Ramona removes her hand from her mouth; Vincent and Kayla continue to look forward with hands in their mouths. The eyes in the group brighten and their heads are raised up. Alex returns to his place on the mat. I feel encouraged.

“Hundreds of stars...thousands!”

Someone in the group affirms, “Hmm hmm!”

Ramona and Alex rock back and forth while repeating, “Thousands!”

Guillermo predicts the next word on the next page with “Millions!”

Then I turn the page and read, *“Millions!”* I notice that Guillermo smiles with satisfaction.

I ask, “Do you know how much a million is? A *thousand* thousands!” All children’s eyes, with the exception of Thomas’s, are on the book or me at this point.

Guillermo repeats, “A thousand thousands?”

Now everyone’s eyes are intently on me as I explain in Montessori terms that they can understand. Most of them have been avid counters of the thousand chain recently. “Imagine the thousand chain, and you know where every bead is on the thousand chain? Instead of it being

one bead it would be a *thousand cube*.” Most of the children are attentive, four of them with their mouths wide open as I explain, “...And then if you stretch it out, it would be a thousand times as long.”

“Just lie here for a moment with all the stars above you and all the Earth below you.”

Guillermo raises his eyebrows up and down a couple of times and interjects, smiling slightly, “Affinity” [sic “infinity”]. I expected that the concept of infinity would enter our lesson at some point and I am not surprised that Guillermo introduces it.

“Those stars over there are fires in the sky. Giant fires a long, long way away. Much, much hotter than a candle’s light, much, much farther than our Sun.” Four of the children have their hands up around their chins, looking pensively at the book. Continuing, *“Let’s have a closer look.”* Thomas repeats the last line. Although he is interjecting during the reading, I see that he is engaged with the topic. Other children’s eyes are on the book.

I read, *“A long, long time ago, this star got hotter...hotter and hotter....”*

Guillermo interjects, “That’s the Sun,” while smiling. Now I see that Alex is looking at the book intently.

“Can you feel the heat yet?”

Ramona and Alex respond, “No!”

“Hotter and hotter and hotter...”

Guillermo interjects again, “That’s the Sun!” Alex’s eyes are on the book, wide open. Vincent repeats, “That’s the Sun!”

I ignore the comments and read with increased volume, "...until it exploded!" All eyes are on the book. Four children have their chins in their hands. Reading, "Are you okay? Yes?"

Teresa responds, "Yes," while several children nod their heads in agreement.

Thomas answers, "The star exploded!"

Alex adds, "No, I'm dead! Ohh!" Vincent and Teresa laugh. I anticipated that the question in the book would prompt a variety of responses. I choose to overlook the side comments.

"When the star exploded, the tiny pieces flew across the sky..." All eyes are on the book. *"...Like lonely little boats. Look at those tiny ones lit up brighter than the rest."* Alex is crouching on his mat, leaning forward. *"There they are flying across space for millions and billions of years."*

Alex reacts, speaking over the lines of the book, "All of them look like pirate...like pirate...boats..." The illustration in the book shows the tiny pieces sailing on ships. His comment is related to the text, but I do not respond to him, trying to keep the reading on track.

"Through the cold and the dark and the emptiness, looking for a home."

Thomas adds, saying about the child character in the book, "He becomes a star." I react internally, thinking that Thomas is anxious to predict the outcome of the story. I do not comment.

"Until finally they come to rest in the place that will be Earth. And the place that will be Earth tumbles and turns with our tiny pieces of star inside."

Thomas adds, "He turns into the star."

"Look! Earth is getting greener and cooler and more beautiful as it turns." All eyes are on the book with the exception of Alex who is looking down.

Thomas persists again, "He's going to turn into the star."

Teresa responds with a puzzled expression and shakes her head, "No." I feel that they are paying attention well as a group.

"And the tiny pieces of star sail through rocks and plants and fires...."

Guillermo points to the pictures in the book saying, "Those are dinosaurs!"

Leon adds, "Yeah!"

Alex has moved off screen, but still repeats, "Those are dinosaurs! I see a flying dinosaur."

I continue reading, with raised volume to regain their attention, *"...through animals and trees...and fruit, until...."*

Thomas anticipates, "He becomes it!"

I read on, *"...you eat the fruit."*

Alex has rolled up his woven mat. Ramona says, "Ms. Linda,"

"...Until the tiny pieces of star are..."

Guillermo interjects, "...inside you!"

I finish, "...inside you!"

Thomas says to Teresa, "I told you. See, he becomes a star."

I have some concern that I am losing their attention. I continue reading quickly, hoping to make the central point, "*Sailing down through your mouth, your tummy, your arm...almost there until the tiny....*"

Ramona points to Alex who is rolling his mat between his hands, "Ms. Linda..."

"... *Pieces of star are at the tip of your finger in amongst the grooves and curves...waving back at you.*"

Ramona points at Alex saying to me, "Alex, Alex took off his mat. You're supposed to sit on it."

I give Alex a corrective glance so he knows that he is misusing the mat, but I refrain from saying anything.

"*It's time to return to your room, snuggle back into bed, but remember, that sky way, way above your bed is not dark and cold. It is the cradle from which you came. You are ...*"

Guillermo and Teresa chime in simultaneously, "...a star!"

Thomas cheers, "Yayyyy!" pointing to the "YAY!" on Teresa's t-shirt again. Kayla does a back roll. Vincent and Ramona mimic little applauses. I am pleased that we have now finished reading the book.

I say, "I want to ask you if you have any questions or comments about the book?" The follow up questions and discussion to this book have been quite rich in the past. I have high

hopes. Kayla returns to upright from her back roll and shoots up her hand along with Guillermo
“Stay seated please,” I remind as Alex and Ramona start to move as if to leave.

Ramona responds, “Aww.”

I acknowledge, “Leon, I think you have a question.”

Leon nods his head and asks, “Umm...why...why did that...she float up into the sky?”

Teresa says, “It’s a he.”

I reply, “You know what? I find it interesting that in this book the child kind of looks like a boy *or* a girl. I can’t tell if it’s a boy or a girl.”

Thomas replies, “A boy.”

Ramona kneels on her mat and raises her hand, “A girl! Who else thinks it’s a girl?”

I add, “Who else has a question?” Kayla and Ramona raise their hands. I call on Kayla.

Kayla is gesticulating in the air, “How does the boy or girl float up in the air? How does it fly?”

I answer, “Oh, well when we get to that part of the book about the child floating to the sky, what do you think the author is asking us to use...in that part of the book?”

Ramona’s hand goes up. Vincent purses his lips together intently. He interjects, quietly, “Imagination?” smiling and looking at me.

I ask, “What did you say, Vincent?” believing he was on the right track.

Vincent repeats with more volume, “Imagination.”

I affirm, “Imagination. Right, I believe we’re to use our imaginations. What if we *could* fly up into the night?”

Ramona asks incredulously, “For real?”

I continue, “What if we could? Imagine what that would be like.”

There are general reactions amongst the children, a few quizzical looks. Ramona closes her eyes and squints with her fingers against her temples as if she is imagining, and a bit of murmuring (unintelligible). Thomas gets up on his mat and jumps up as if he is taking off into the sky. Upon his landing he bumps Ramona who responds, “Ow, Thomas kicked me.” I remind the children that the mats are for sitting, hoping to contain the movements.

Guillermo has a question. “How does the boy or a girl be a star?”

Alex also gets up on his feet, jumps off his mat, then points to Thomas smiling sheepishly when I give him a corrective look.

I attempt to clarify, “Oh, how is it, why does the author say that you are a star?”

Ramona replies, “Good question, Guillermo!”

There is general movement amongst the children.

I review the book. “Remember when the star explodes? It gets hotter and hotter until finally it explodes? There’s a special name for a star that explodes. I’m going to show you that picture.”

Ramona offers, smiling, “Urstalenium!”

I feel amused that she can invent such an impressive multi-syllabic word so quickly for the supernova. I point to the picture in the book. “This is called a supernova.” Students become quiet and still. All eyes are on me again, with the exception of Alex who is off screen. “There are stars that, on occasion, explode. And when they do, their stardust goes for millions and billions of miles through the Universe.”

Guillermo says, “Infinity beyond?”

I continue, “...including coming all the way to Earth. Yes, maybe infinity and beyond...And when that stardust comes all the way to Earth it helps to *make* our planet Earth.”

Thomas and Ramona are lying on their stomachs on the floor. Ramona gasps.

Continuing I explain, “Our planet Earth has stardust in it. And when you eat the plants that grow on the Earth,” nearly all eyes are on me now, “where does that stardust go? Well, the stardust goes into the plants...and then that stardust goes into *you!*”

Chattering amongst the children, as they talk about the pictures of plants and dinosaurs on the page in the book. Teresa comments, “The flying ones are pterodactyls.” Thomas fiddles with his mat. I offer with hand gestures that I will hold it for him.

I emphasize, “Everybody here, not just you, not just me, but everybody in our school, everybody across the street....” Children glance out the window at the neighbors’ homes, “...everybody in your neighborhood, everybody in Colorado....”

Kayla interjects, “Everybody on Earth.”

I persist with my spontaneous line of thinking, attempting to build a mental set of nesting

Russian dolls "...everybody in the United States, everybody in North America..."

Ramona kneels on her mat and shouts, "Everybody in Texas!"

I continue, "...*everybody* on *Earth*..."

Ramona inserts, "...in Mexico!"

Vincent adds, "Even Africa!"

I affirm, "Even Africa. *All* parts of the Earth have stardust in them.

Teresa inquires, "Even Pennsylvania?"

Ramona extends the question, "Even where my grandma Pita lives?"

I request, "Ramona, please bring me the globe, the colored globe that we use for our birthday celebrations."

Vincent wonders, "Even New York?"

I confirm, "Even New York."

There is a general clamor as children shout out states where they have relatives, chuckling.

I agree, "It's pretty exciting when you think about it, isn't it?" I collect a couple of mats that are distracting the children from the conversation and remind the children that the mats were to insure that they would be included in the picture.

Ramona has brought the globe. I say, pointing to the globe, "Now here is our planet, Earth. When the supernova exploded, the stardust travelled through space and mixed in with the

Earth...”

Guillermo adds, “All the way to North America.”

I explain, “All the Earth got stardust in it...all of it. So everybody who lives on the Earth... Sonya, Leon, Kayla, Guillermo, Vincent, Thomas, Alex, Teresa, and Ramona, you all have stardust in you....”

Teresa asks me, “Did you say Vincent?”

I reply, “I think I did. But so does everybody else who lives on the Earth, including my dog. Stardust has stardust in her.” [I mention Stardust because I have told the students funny stories about my dog. In fact, my family named her Stardust for the very reason that I am giving this lesson.]

Teresa wonders, “Does my dog have it?”

I answer, “Yes, Pip has stardust in him, too!”

General clamor as children react, shouting out about their pets. Guillermo covers his ears.

I am excited by their excitement. “Every living being on the entire Earth has stardust.”

Leon inquires, “Does my Luna cat?”

I am amused by the pet’s name. “Luna cat? Luna cat means ‘Moon cat.’ Luna means ‘moon.’ It’s Latin. You know how we count in Latin?” [I say this in an attempt to remind them what Latin is. They already know it is an ancient language.]

Collectively some children start to count in Latin. There is a lot of movement among the

children now. Alex has wandered away.

I try to bring their attention back. We often count in Latin as a prompt for settling down. “Well, everyone have a seat again and we’ll count in Latin. (Together) Unus, duo, tres, quattuor, quinque, sex, septum, octo, novem, decem. Luna is Latin, too, and it means moon. So Luna Cat means ‘moon cat.’ And my dog’s name is Stardust ...and [now I’m joking] her name means ‘*stardust*’ because she’s made out of stardust, just like *I’m* made out of stardust and just like *you’re* all made out of stardust....” The children are intently re-engaged in the discussion again. “Just like *every* living thing on the Earth is made out of stardust.”

Thomas says, “I have stardust in my *house*.”

I am happy to see his expression and pleasure in his idea. “You have stardust in your house?! Think, isn’t that exciting? You are made out of the same things as a star....” Ramona gasps and sighs, falling over dramatically.

Teresa adds, “Even a cat named Luna?”

I am participating in this infectious enthusiasm. “Even a cat named Luna or a dog named Pip. Even an earthworm named Wiggly Woo.”

Ramona sits up in excitement, her eyes and mouth wide open and starts singing and wiggling to the song that the children learned earlier this year about an earthworm. Spontaneously, led by Ramona and Thomas, the group, smiling, breaks into the song, “Wiggly Woo.” Of course, I join in, too.

Conclusion

Maturana and Varela defined and examined the process of autopoiesis. All beings are self-constructing. Our environments influence us, and likewise, we reciprocally have an influence on those environments. Those with whom we have contact through these processes do not only affect us, but also are in turn, affected *by us*. Maturana and Varela isolated this sub-concept and called it structural coupling.

In my teaching experiences particularly, I have felt the reciprocity between teacher and students firsthand, as my students sway my mood, my thought processes, and my inspiration through their actions and reactions. The reciprocity is always there, but on special occasions, in planned lessons or in unplanned spontaneous moments, it develops into a uniquely powerful experience. I sense that a spirit moves me and I feel connected beyond my *self* to the cosmic collective, my words originating from a “distant” and powerful source. I have felt very profoundly the desire to be a better person and teacher for their sake, seeing their young innocence, especially when I am a part of their enthusiastic responses to a lesson. Just as I have benefitted from my time with my students, my hope is that I have benefitted them as well, in many more ways than by increasing their test scores. I hope that they better understand and appreciate the Universe and world around them, their lives and those of others, and that they develop a deep and abiding connection to the natural world and the Cosmos beyond it.

The neurophenomenological approach to examining the interactions in the recorded lesson, *You Are a Star*, allowed me to view more clearly the exchanges that occurred in that process. As I watched the group as a whole and also each child’s reactions and participation in the lesson, I came to the conclusion that most of the children were quite engaged throughout the lesson. Their facial expressions and body language indicated that they were paying attention for

the majority of the lesson. Their questions and comments demonstrated that they were processing the concepts and reflecting upon how those concepts affect them. They made some unique connections during the discussion, such as Ramona, who tried to create an original name for the supernova; Thomas, who said that he has stardust at his house; and Teresa and Leon who were excited that their pets have stardust in them. Overall, it seemed that they were focused and actively participating for the majority of the lesson's duration.

The individual child for whom I did a third person observation normally has difficulties attending to lessons for more than three to five minutes. This particular lesson lasted around fifteen minutes with the ensuing discussion, longer than his typical focus. Although he showed definite signs of restlessness, he continued to respond in an engaged manner with comments and physical signs of attention for most of the lesson. When he could no longer sit still toward the end of the discussion period, he arose from his seat and walked around. He still watched the group from a distance and then came back to rejoin them at the end.

My own expectations for the lesson were largely met by the students' reception of the book and the ensuing questions and discussion. I was pleased by their inquiries as to who has stardust in them. Most of my responses were entirely spontaneous as I, too, participated in this autopoietic experience. It seemed natural to create a geographic metaphor for a Russian nesting doll, using the state and continent names that they have learned in class. It was interesting to me that they needed to check if their distant relatives, all over the United States, would also contain stardust. I was again swept up by their enthusiasm for an earthworm with stardust in it, just as I had been a couple of weeks earlier when they broke out into song in the school garden.

In conclusion, the theory of autopoiesis states that as humans we are self-creating, but we

also have a profound interdependence on one another. It is of value to remember while moving forward, as John Donne's poem reminds us, "No man is an island." We each affect those around us with our thoughts, our words, and our actions. Maturana and Varela summarized it thusly, "Everything we do is a structural dance in the choreography of coexistence" (1987, 1992, p. 248). It seems that as we each live our lives, we do so not only for ourselves, but also for others. Montessori would urge us to embrace our cosmic tasks with the inspiration to create a better world, both for others and ourselves.

Chapter 9: Educating to Re-integrate the Whole

Introduction

As parents, educators, and communities, we have a “cosmic task” before us: How shall we educate the Ecozoic human who is *re-integrated* with the Universe? I look at two quotes from Berry for inspiration:

“...[A]ny recovery of the natural world in its full splendor will require not only a new economic system but a conversion experience deep in the psychic structure of the human” (1999, p. 60).

“The greatest of human discoveries in the future will be the discovery of human intimacy with all those other modes of being that live with us on this planet...” (1999, p. 149).

How will humankind make these discoveries? I feel that schools can lead the way. Schools may be the *best* hope for shaping the new Ecozoic human. Children from the very earliest age have an inborn affinity for nature. It may be because it is encoded in our very DNA. Federman wisely asked in our integrative seminar “WWND: What Would Nature Do?” (2014 July). So in extension, I ask, would Mother Nature remove bird hatchlings from their nests or deer fawns from the woods to be raised in artificial environments? Preserving that affinity in the human child seems key. Living in and with nature from birth may yet hold hope for humankind living harmoniously on the Earth.

Muir also suggests the direction education should take: “Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul alike” (1912, p. 256).

The “First” Prepared Environment

Within the community of Montessori educators, the term “the prepared environment” refers to Montessori’s concept that the classroom must be properly prepared to meet the fundamental needs of the developing child. It would take into consideration the child’s sensitive periods of brain development at each age level and provide the necessary elements to fulfill the child’s needs.

However, it is important to be reminded of humanity’s *first* prepared environment—the natural world. We cannot separate ourselves from this home in which we live; we are a part and parcel of it, and like its other inhabitants, there is a balance and a harmony that we must find in order to survive. Margaret Stephenson, a student of Montessori’s and a trainer of teachers at the Washington Montessori Institute, emphasized the importance of the first prepared environment.

The universe was the first prepared environment for man and, with the coming into being of the universe, we find directives within the elements of which it was composed and laws being obeyed, though unconsciously, to bring order out of chaos. (1993, p. 21)

Before man came, the universe came, the earth came, life came, and lastly there came man. When man came, the environment had been prepared for him; furnished and decorated, star-hung and jeweled, embellished with every imaginable form of life and colour, of scent and shape, of glory and wonder. (1993, p. 24)

In Montessori’s view of education, the child is viewed as the agent of cosmic change. In order to fulfill this important role, children must be allowed to develop as nature intended, with the first prepared environment playing a major part in their education. It is critical that as parents, educators, and as a society, we do not interfere with the child’s relationship with the first environment.

The universe came into being following laws for its creation; plant and animal life furnished the land and water following directives for their lives. Is it not reasonable to

think that man also was given a formula for his construction, a plan for his completion of himself, an order for his happiness? For the child to become the cosmic agent for the change in humanity that seems so needed, the formula for the construction of man cannot be tampered with. Whenever and wherever an activity or an end rests upon a formula, the result is only achieved if the formula is adhered to. (Stephenson, 1993, p. 23)

Therefore, if the child is to complete the task of autopoiesis and construct the new Ecozoic human, as parents, educators, and as a society we need to look to fulfilling those needs and not impede the child en route to this fulfillment. Montessori clearly states her vision for what she termed a “cosmic education.” The following is a quote from a lecture given in 1944 in India.

“... We believe that in the cosmos there is harmony; that everything that is in it, both the animate and the inanimate, have collaborated in the creation of our globe, correlating in doing this their single tasks. But we think that among the innumerable agents which participated in this creation, man has had, and has, a very important task. Also that creation is not finished and that the one agent which as yet has not been taken into consideration has been the child.... It is the question of making use of the last cosmic agent, the child.... To the young child we give guides to the world and the possibility to explore it through his own free activity; to the older child we must give, not the world, but the cosmos and a clear vision of how the cosmic energies act in the creation and maintenance of our globe.” (Stephenson, 1993, pp. 16-17)

As we seek to bring harmony back into the “maintenance of our globe,” it seems important to recall Montessori’s “cosmic task,” which is so concisely summed up by Stephenson. “The cosmic task of all the elements of the universe is the service to be rendered by each to the environment” (1993, pp. 24-25).

When we consider our future direction as parents, educators, and as a society, Montessori’s wisdom from a lecture given in India in 1947 might inspire us.

“When we educate the children we must appeal to this sensitivity which forms parts of the nature of man. This sensitivity towards nature must be given as something which is useful not as an abstract thing but as a real sentiment. We must cultivate this sense of gratitude and, if developed, it can form a basis—this admiration for nature—this sense of mystery must accompany the study of nature. When having learned of those wonders, the

child goes out and sees nature at work. This is a constant exercise and if carried out in calm and tranquility, which touches and educates that sentiment, they see it as a reality that happens every day as in the past or future. It is evident that if this sensitivity disappears and is not allowed to develop, the life of man becomes a harsh life...[sic] This sensitivity must not be developed for nature and the stars and flowers only but especially for mankind...[sic] The importance of education is to use the sensitivity for nature and develop it in the soul of the child at this age, in order to save society.” (Stephenson, 1993, p. 25)

Recommendations for Educating the Ecozoic Human

Beginning with the young child of the Montessori primary (pre-school) ages, schools could incorporate some of the following features into their programs to promote Ecozoic thinking:

- Green spaces on school campuses and in communities
- Unstructured playtime in the green spaces
- Gardening activities
- Outdoor environments connected directly to classrooms as workspaces
- Plants in the indoor environments
- Animal care
- Thoughtful incorporation of computer and electronic media usage
- Outdoor education programs
- Nature and/or environment clubs
- An environmental/conservation/ecology oriented curriculum
- Sustainable practices - Recycling/Conservation/Energy efficient architectural designs/Renewable energy
- Parent education and involvement

There is mounting evidence through several research projects cited in Chapter 5 (Louv, 2008) that green spaces on school campuses, plants in classrooms, outdoor education programs, and ecologically oriented curricula are not only helping to create healthier, better adjusted, and more intelligent students (with test score results to corroborate this)—but that these could become the new Ecozoic humans that our civilization will need to find sustainable ways of living in cooperation with the Earth.

A new movement in Scandinavia, Germany, the United Kingdom, and the United States is that of the outdoor nursery school. As covered in a recent article in *The Denver Post*, these schools allow children

...to learn and let their imagination run free, completely surrounded by nature...University of Reading professor Helen Bilton said the benefits are clear. “In terms of health, it is to do with exercise, and things like that... But in terms of education, it is to do with cognitive development, linguistic development, social, emotional. It covers a lot” (Stars, 2014).

Moore, the expert in designing playgrounds and learning environments, writes that natural settings stimulate all the senses better than structured playgrounds and integrate informal with formal learning. These

...multisensory experiences in nature help to build “the cognitive constructs necessary for sustained intellectual development,” and stimulate imagination by supplying the child with the free space and materials for what he called children’s “architecture and artifacts. Natural spaces and materials stimulate children’s limitless imaginations and serve as the medium of inventiveness and creativity observable in almost any group of children playing in a natural setting,” says Moore. (Louv, 2008, pp. 86-87)

Louise Chawla is a Professor in the Environmental Design Program at the University of Colorado in Boulder, co-editor of the journal *Children, Youth and Environments*, and Associate Director of the Children, Youth and Environments Center for Community Engagement. She agrees with Louv and Haring in her assessment of the value of natural environments.

In our society full of stresses, nature can be a healing haven. We hear about benefits of nearby nature for children's increased physical activity, improved concentration, and reduced asthma, but equally important is the value of natural areas as places to shed stress, recharge, and put day-to-day problems in perspective. (2006)

Chawla supervised the dissertation research of three different graduate students. Each doctoral student observed and interviewed the play behaviors of school children who had access to natural areas on their playgrounds.

The younger students voted for the value of nature play with their feet. Almost to a person, they headed for the woods during recess rather than the school's athletic field or built playground. There they observed small animals like squirrels and salamanders, waded in a stream, built dams, constructed forts, and traded found objects like wild apples and quartz—all with rapt absorption. In contrast to the freedom and happiness that they reported feeling in the woods, they recalled recess on asphalt surfaces and flat grass playing fields at previous schools as “BORING!” “torture!” “a rip-off!” Alumni of the school and parents described the woods as a safe haven where children could test out different social roles during the creative, cooperative play that the woods afforded, demonstrate competence at their self-appointed tasks, and escape classroom stresses. (2006)

Rodney Matsuoka of the University of Michigan published a study in 2010 of the effects that greenery had on academic performance. The study involved 101 high schools in Michigan. He evaluated the classroom and cafeteria environments for the degree of and types of nature in the window views. Even after controlling for socioeconomic factors, class size, and other factors, the results showed that students who had natural views of trees and shrubs through the windows performed significantly higher on standardized tests than their peers who did not have natural views (Selhub & Logan, 2012).

In 2004, researchers at the University of Illinois found that activities conducted in outdoor natural spaces resulted in reduced symptoms in students diagnosed with Attention Deficit/Hyperactivity Disorder as compared to the activities conducted indoors. The researchers worked with 452 parents of children who had been diagnosed with ADHD. They conducted a

test of fifty activities both indoors and outdoors, ranging from playing sports to reading. Regardless of age, socioeconomic bracket, or geographic location, they found the symptoms of ADHD to be significantly reduced in the activities conducted in natural spaces (Selhub & Logan, 2012).

Chawla has also discovered academic, physical, psychological, emotional, and social benefits when children have free playtime in green spaces. In three separate dissertation projects, doctoral students observed children who had the options to garden or play in natural green spaces at school during recess, instead of on the athletic fields or the asphalt playground. The resulting interviews were revealing:

When they were asked, “How do you feel while gardening?” and “How do you feel after gardening?” not one out of 52 students reported negative feelings. When all the words that they used to describe gardening were counted, they used the words “calm,” “peaceful” and “relaxed” 46 percent of the time. Other positive emotions that they expressed were happiness, joy, feeling good and feeling love.

When they were asked whether their capacity to pay attention changed after gardening, 51 out of 52 said that it improved. They also found gardening a contemplative task that gave them time to center and put the stresses at home and at school into perspective. (2006, p. 3)

Michael Stone and Zenobia Barlow of the Center for Ecoliteracy in Berkeley, California, have edited a collection of essays to address the need to achieve ecological literacy-- ecoliteracy—a necessity for the Ecozoic Age. School gardens are a key element of ecoliteracy. Gardens weave together our need for sustenance with the cycle of the seasons, the climate, the soil, the microorganisms, the plant life, and the secrets of generation. Alice Waters, a chef, founder of a restaurant, and a vice president of Slow Food International, supports the school gardening movement because she believes that food choices affect us on every level—as individuals and as a society. She is concerned about the lessons our children learn from fast food

in the form of a Happy Meal. Fast food lessons are: 1) Food is cheap and abundant, 2) resources are unlimited, 3) eating is about consuming food as quickly as possible, 4) meat, French fries and sodas are good for us and taste the same everywhere, 5) where food comes from does not matter, 6) advertising makes products valuable, and 7) the work of food preparation is to be avoided (2012).

Our system of public education operates in the same strange, no-context zone of hollow fast-food values. In school cafeterias, students learn how little we care about the way they nourish themselves— we've sold them to the lowest bidder. At best we serve our children government-subsidized agricultural surplus; at worst we invite fast-food restaurants to operate on school grounds. Soda machines line the hallways. Children need only compare the slickness of the nearest mall to the condition of their school and the quality of its library and its cafeteria to learn that our culture considers them more important as consumers than as students. (2012, location 1137)

This view of children as consumers brings me back to Berry's extractive economy and the damage it has wreaked upon our ecosystems. At a fundamental level, we need to change a lot as a society. But where do we start? Waters concurs that education offers our society the most effective avenues for creating change.

Still, the public school system is our last best hope for teaching real democratic values that can withstand the insidious voices of those who would have us believe that life is all about personal fulfillment and personal consumption. A slow food education is an opportunity that should be universally available.

Change the food in the schools, and we can influence how children think. Change the curriculum and teach them how to garden and how to cook, and we can show that growing food and cooking and eating together give lasting richness, meaning, and beauty to our lives. (Stone & Barlow, 2012, locations 1137-1146)

In addition to gardening programs, communities could support schools and families through the development of urban green spaces and environmental programming. There might be a collaboration between communities and their schools. Since schools often serve as centers for

their neighborhoods, developing natural areas on or near school campuses would benefit many community members in addition to the children who attend the school. This would help adults, such as the parents themselves, to reconnect with nature and to raise their children with access to the green spaces that seem to beckon to our DNA. Additionally, community development of natural areas would help to narrow the socioeconomic gaps experienced by residents in blighted urban areas.

Access to parks and greenspace narrows the socioeconomic health inequality gap. Socially deprived urban schools are not surrounded by urban woodland; rather, they are belted by industrial zones, convenience stores, and clusters of fast-food outlets, so-called gray space—up to five and a half times more than in wealthier areas. For the schoolchildren who need it the most, dietary greens are off their plates and landscape greens are out of view. Cities need parks and greenspace not only as a means of encouraging physical activity; all of its citizenry regardless of socioeconomic position, should be entitled to utilize the *vis medicatrix naturae* [the healing power of nature]....(Selhub & Logan, 2012, p. 230-231).

Ideally, it would seem that school children would benefit from being in classrooms with direct contact with the natural world. Schools could be designed that would allow classrooms immediate access to an outdoor space that could be used for nature studies, a place to do schoolwork outside, or as a place to enjoy the beauty of nature and calm oneself. Many Montessori classrooms have this feature. If children could choose their ecotherapy when needed, they may have better attention spans, make better progress in school, and enjoy better health overall.

The presence of plants and animals in the learning environment also seems to bestow benefits on students. Classrooms could easily contain several houseplants, which would not only improve the learning conditions, but would also give the children the opportunity to care for the plants. The connections between pet ownership and physical and mental health are evident: pets

can lower our stress hormones and improve other measurements of stress physiology. Classroom plants and pets also would provide educational experiences, opportunities to learn stewardship, and the chance to develop empathy for other living creatures.

It seems evident that care should be taken in the introduction of electronic media to young children. Studies point to deleterious affects on children's attention spans as well as their lack of engagement with the natural environment when they are allowed to spend significant amounts of time using electronics. How do electronic stimuli alter healthy brain growth? Although the digital world has become a way of life in the United States, exposing children to it at an early age seems to change normal development of the brain and can even result in addiction. More research would be helpful as well as pedagogical guidelines for parents and educators that would protect healthy brain development.

Outdoor education programs seem to connect students to the natural world in meaningful ways that make a lasting impression. Indeed, for urban and suburban children in particular, such programs may provide opportunities that they have never had. For many students, these experiences prove to be an awakening to the natural world. That is how the first peoples of North America learned about nature. Malcolm Margolin, an important publisher on Native American topics, explains that the outdoor world is our teacher.

In cultures without writing, instruction can best be preserved by packaging it as a story and then attaching the story like a billboard to an animal, plant, or place so that people will constantly be reminded of it. That's valid, but I think there is something more: a sense that animals, plants, and everything else we see have something to teach us, that the important lessons in life are not just held by people but are part of the larger world. The world contains things that we need to know that are too important to be left solely to human beings, and these essential lessons are embedded in the animals, plants, mountains, and rivers around us. Learning, in short, does not just take place only in

deliberate teaching situations between people. The entire world is a teacher. (Stone & Barlow, 2012, location 1491)

Nature or environment clubs for children either through schools or local recreation departments could develop and support their interest in the natural world in a social setting. The children could experience the benefits of being outdoors. Hiking or biking groups, adventure clubs, 4-H, scouts, Roots and Shoots are all healthy options. The social network of learning and participating alongside peers with similar interests might also reinforce the value of the activities and prove more satisfying to students whose social needs could also be met.

Our society needs to develop an environmentally, ecologically oriented educational curriculum if it is to find more sustainable ways of being on the Earth. It is important to work from the ground up to prepare future generations in ecoliteracy. Montessori would consider it an integral part of cosmic education. In every realm of education, Montessori and beyond, it is a need. David Orr, a professor of environmental studies at Oberlin College, suggests that it is a conversation that needs to happen.

An ecologically literate person would have at least a basic comprehension of ecology, human ecology, and the concepts of sustainability, as well as the wherewithal to solve problems. Taken to its logical conclusion, the goal of making all of our students ecologically literate would restore the idea that education is first and foremost a large conversation with technical aspects, not merely a technical subject.... Education...[has] to do with the timeless question of how we are to live. And in our time the great question is how we will live in light of the ecological fact that we are bound together in the community of life, one and indivisible. (Stone & Barlow, 2012, location 170)

It is not just ecoliteracy, but biophilia that seems to be needed. Our emotions, our hearts beg to be engaged in meaningful ways in order to feel connected. Pamela Michael, cofounder and executive director of River of Words and a contributor to *Ecological Literacy: Educating Our Children for a Sustainable World*, explains the importance of love.

Because environmental education, like much education, often fails to acknowledge the crucial role of emotions in the learning process, activities that both inform the mind and engage the heart proved to be a powerful and effective combination. [At River of Words] [w]e soon began defining our mission as “helping children fall in love with the earth.” Because people protect what they love, this is a powerful prescription for stewardship, and ultimately, we hope, kinship. (Stone & Barlow, 2012, location 2147)

Homes, schools, and communities could model sustainable practices through recycling, renewable energy production, energy, water usage, and resource usage. Our children learn best from what we *do*, not what we *say*. As adults it is critical to model what we preach. Recycling, conserving resources, using renewable energy—our children would learn by seeing these practices in action. There are models for sustainability—it is not a matter of reinventing the wheel. Capra explains in the preface to *Ecological Literacy: Educating Our Children for a Sustainable World*:

... We do not need to invent sustainable human communities from scratch. We can learn from societies that have sustained themselves for centuries. We can also model human societies after nature’s ecosystems, which are sustainable communities of plants, animals, and microorganisms. Since the outstanding characteristic of the biosphere is its inherent ability to sustain life, a sustainable human community must be designed in such a manner that its ways of life, technologies, and social institutions honor, support, and cooperate with nature’s inherent ability to sustain life. (Stone & Barlow, 2012, location 182)

Parents, schools and communities could work together. We are all part of Team Planet Earth. Parents who grew up disconnected from the natural world sometimes feel it is daunting to provide their young children with nature experiences since they themselves lacked those opportunities. Parent education and support groups through schools and communities could educate and encourage parents to take the necessary steps to get their children out in nature. Carson, in her book *Sense of Wonder*, inspires us just to venture outside and share the natural beauties that we see with our children.

If a child is to keep alive his inborn sense of wonder without any such gift from the fairies, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in. Parents often have a sense of inadequacy when confronted on the one hand with the eager, sensitive mind of a child and on the other with a world of complex physical nature, inhabited by a life so various and unfamiliar that it seems hopeless to reduce it to order and knowledge. In a mood of self-defeat, they exclaim, “How can I possibly teach my child about nature—why, I don’t even know one bird from another!”... I sincerely believe that for the child, and for the parent seeking to guide him, it is not half so important to *know* as it is to *feel*. If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds much grow. The years of early childhood are the time to prepare the soil. (1965, 2011, location 87)

In Montessori’s years in Sri Lanka at Kodaikanal, she and her son, Mario Montessori--himself a trainer of teachers and later the Director General of the Association Montessori Internationale, developed their first ideas of cosmic education in a similar fashion to Carson’s philosophy. They shared many outdoor explorations and gardening experiences with the children. Naming and classification activities *followed* the initial direct contact with nature as observers, participants, and admirers first. Analysis was secondary to *immersion* with nature. The following quote is from Mario Montessori in an interview with David Kahn, the executive director of the North American Montessori Teachers’ Association:

I went outside...to interest them in nature. How did the trees grow. [sic] We had a little garden that was worked by the children. They took care of the flowers. They cultivated the plants. We had every variety of species to enhance classification. We went to the garden to observe—many times just to see. (1979, p. 56)

Observation seems to be key to engagement with nature. A new nature movement in our communities might even create a network of resources to provide “nature kits” to parents and children for going on outings together. Schools could provide parent education and promote family nature clubs. Parents could work together with other families to ensure that their children

will have direct experiences with nature on a regular basis through multifamily hikes and activities (Louv, 2011, 2012).

Chapter 10: Conclusion

I have examined the millennia of humankind's history in an effort to get to the root of a critical problem: How does humankind re-integrate itself with the whole of nature; how is the Ecozoic human created, starting with the child?

My answer begins with this additional question: We can take the child out of nature, but can we take nature out of the child? Leading researchers have concluded that we cannot. It seems that humankind is irrevocably connected with nature; it is evident in our very DNA.

In 2003, Peter Buckley, the Center for Ecoliteracy's cofounder and board member stated

[T]he ecological problems we face are problems of values. We've noticed over the years that it's very hard to change the values of adults, while at the same time we've noticed that children are born with certain values intact—namely their sense of wonder and their affinity for nature.... E. O. Wilson calls this "biophilia." We all share that trait, but it seems particularly strong in children. It's undiminished when they're young. And one of our philosophies is that we think that, properly nurtured, biophilia can develop into ecological literacy and eventually lead toward a more sustainable society. (Stone & Barlow, 2012, location 992)

A key to re-integrating our species with the whole of the Universe is to nurture the biophilia with which we are born. As parents, as educators, and as communities we can act to preserve this sacred bond between children and nature. Our first step is to recognize and understand how important it is.

Critical to our success will be the availability of green spaces for all to enjoy and thrive. If communities re-green the landscapes, this valuable connection between humans and nature can be renewed. Louv believes,

Our society must do more than talk about the importance of nature; it must ensure that people in every kind of neighborhood have everyday access to natural spaces, places, and experiences. To make that happen, this truth must become evident: *We can truly care for nature and ourselves only if we see ourselves and nature as inseparable, only if we love*

ourselves as part of nature, only if we believe that human beings have a right to the gifts of nature, undestroyed. (2011, 2012, p. 269)

Educators will most likely play a special role in our future. Orr agrees. He states,

I think H. G. Wells had it right when he said that we are in a race between education and catastrophe. This race will be decided in all of the places, including classrooms, that foster ecological imagination, critical thinking, awareness of connections, independent thought, and good heart. (Stone & Barlow, 2012, location 159)

Stephenson concurs and expands upon this theme. Education today needs to be about much more than academic subjects and test scores. The first prepared environment becomes central. The future of our planet depends upon the education of our children.

The adult at the elementary level has a grave responsibility not to teach academic subjects but to prepare the child for a recognition of his responsibility as a human being towards the environment and human society. We can only do that if we understand the responsibility ourselves; if we appreciate the great drama that is the Cosmic Plan; if we can enthuse and intrigue the children and excite them about this dramatic act that is creation in all its manifestations. (1993, p. 28)

I wholeheartedly agree that education offers us hope towards fulfilling the promise of the Ecozoic Era that Berry envisioned. In order to reach this goal, there is an urgent necessity for collaboration between parents, schools, and communities. With vision, dedication, and teamwork, we can help to re-integrate our children, as well as our society, with the wholeness of nature. As members of the human race, we each have an important cosmic task to fulfill as we confront the challenge of our time--to live in ultimate harmony with the Earth.

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