Title: How Language Limits Our Understanding of Environmental Education

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The role that the metaphorical nature of language plays in contributing to cultural patterns that are rapidly degrading the Earth's natural systems too often is overlooked by educators, particularly environmental educators. For example, how many educators are able to recognize how the language in the following description of a widely used environmentally oriented software program in the United States reproduces the double bind inherent in the view of progress currently used to justify the digital phase of the Industrial Revolution (now called globalization)? The SimLife software program, according to its designers,

> Is the first genetic engineering game available for personal computers. It lets players manipulate the very fabric of existence, giving life to creatures that defy the wildest imaginations. Players create exotic plants and animals of various shapes, sizes, and temperaments, and turn them loose into a customed-designed environment, in which only the best-adapted survive. Maxis,1995, p1.

Iconic metaphors such as "engineering," "manipulate," "create," and "custom-designed environment" fit the taken-for-granted thought patterns of most western middle class teachers and students. Even more important to understanding how the metaphorical encoding characteristics of language organizes thought are the culturally specific root metaphors (or meta-schemata) in this promotional statement. The two most ecologically problematic root metaphors represent all technologically based change as the expression of a linear form of progress, and an anthropocentric view of human/Nature relationships. In effect, the software program reinforces the same deep pattern of thinking that underlies current efforts to make genetic engineering the basis of industrial approaches to agriculture and medicine. It also updates the myth of linear progress by restating the part of the evolution metanarrative that eliminates the need for human accountability: that is, failed human experiments do not really

matter because Nature ensures that "only the best-adapted species survive."

The double bind, as Albert Einstein put it so succinctly, is in using the same mind-set to solve a problem that created it. The mind-set reinforced in the SimLife software program, in effect, exhibits the same hubris that has led, over the last three hundred years, to a series of environmental miscalculations and destructive technologies. The language used to explain the software's educational significance contains all the legitimating metaphors that most educators, including environmental educators, associate with strengthening the students powers of self-direction--which raises questions about how language carries forward and reproduces in the teacher's taken-for-granted thought patterns pre-ecological ways of understanding.

This problem can be traced to the lack of awareness on the part of most scientists, environmental educators, and experts who produce curriculum materials of the metaphorically layered nature of language--and how it carries forward earlier culturally specific ways of thinking. Like most graduates of our western educational institutions, they either view language as a conduit for communicating "objective" information and data, or they think of language in terms of representing objects and relationships. As I have written elsewhere (1990, 1993, 1995, 1997, 2000, 2001) about how culturally specific root metaphors frame the process of analogic thinking, and how the prevailing analogy is, over time, encoded in iconic metaphors such as "data," "sustainability," "genetic engineering," and so forth, I will summarize how language thinks us as we think within the epistemic possibilities of our language community. I will use examples of how the language of science and, more specifically, environmental education, puts out of focus the importance of understanding the cultural patterns that are undermining the viability of natural systems. I will also suggest how "ecology" can be understood as a root metaphor that foregrounds the importance of going beyond an eco-management approach to environmental education in ways that address eco-justice issues.

The influence of the cognitive schemata carried forward in a cultural group's languaging processes can be seen in how the root metaphors of patriarchy, anthropocentrism, subjective/rational individualism, mechanism, and progress provided the conceptual direction

and moral legitimacy to scientific inquiry. Patriarchy is now being replaced as a root metaphor by economism as science, technology, and multinational corporations become more interdependent. These root metaphors provide a taken-for-granted conceptual framework that frames the process of analogic thinking used to understand new phenomena. Over time, the prevailing analog (conceptual schema or model) becomes encoded in iconic metaphors that become a taken-for-granted part of the professional discourse--until overturned by new discoveries. However, the root metaphor may continue to fit the new insights into the old meta-schemata.

An example of this process can be seen in how the root metaphor of mechanism has served as a basic conceptual framework for over four hundred years of scientific discovery. Johannes Kepler (1571-1630), for example, wrote that "my aim is to show that the celestial machine is to be likened not to a divine organism but to a clockwork" (Marchant, 1980, pp. 128-9). Marvin Minsky, an early leader in the field of artificial intelligence, utilizes the same root metaphor to explain how our "conscious thoughts use signal-signs to steer the engines in our minds, controlling countless processes of which we'er never much aware" (1985, p. 56). In addition to describing the body as a "survival machine," Richard Dawkins states that "brains may be regarded as analogous in function to computers. They are analogous in that both types of machines generate complex patterns of output, after analysis of complex patterns of input, and after reference to stored information" (1976.p. 52). The prevalence of the machine root metaphor also can be seen in the scientific writings of Antonio R. Damasio (1994), Francis Crick (1994), and E.O. Wilson (1998)--to name just a few of the more prominent scientists. The root metaphor of mechanism can also be seen in the university classroom explanation of the cell where the mitochondrion is labeled as the "powerhouse," the Golgi apparatus as the "storage plant," and the lysosome as the "recycling center."

These examples illustrate how root metaphors provide a meta-cognitive schemata that, in some cases, influence thought and a wide range of other cultural practices that can be traced back hundreds, even thousands of years. Indeed, the root metaphors of patriarchy and

anthropocentrism can be found in the Book of Genesis. Mechanism, the root metaphor that continues to influence such cutting edge areas of science as brain research and the Human Genome Project, has also influenced western approaches to medicine, architecture, education, agriculture--not to mention our language and thought patterns.

The scientists' quest for new knowledge, regardless of its relevance to the challenges being magnified by overshooting the sustaining capacity of natural systems, can also be traced to the taken-for-granted status of the meta-schema that leads to equating change with a linear form of progress. The presence of other root metaphors can be easily documented by giving attention to what they put in and out of focus. Like the process of analogic thinking and the use of iconic metaphors, the root metaphor simultaneously illuminates and hides aspects of the phenomena that is the object of understanding. This process can be seen in how the root metaphor that equates the search for new knowledge with progress is the taken-for-granted basis of Carl Sagan's explanation of the power of scientific inquiry. According to Sagan, science

> urges on us a delicate balance between no-holds-barred openness to new ideas, however, heretical, and the more rigorous skeptical scrutiny of everything--new ideas and established wisdom....One of the reasons for its success is that science has built-in, error-correcting machinery at its very heart. Some may consider this an overbroad characterization, but to me every time we exercise self-criticism, every time we test our ideas against the outside world, we are doing science. When we are self-indulgent and uncritical, when we confuse hopes and facts, we slide into pseudoscience and superstition. 1997, p. 30

If we consider the number of synthetic chemicals now introducing unanticipated changes in natural systems (such as the ozone layer and the rapid decline in the number of amphibians), or examine the racism basic to earlier scientific efforts to measure intelligence (Gould, 1981), it can be seen that Sagan grossly overstates the ability of scientists to steer a safe course.

In addition to how the root metaphor equates change with progress, the language Sagan uses performs another function. That is, it foregrounds the essential characteristics of an idealized mode of inquiry while simultaneously hiding how different cultural epistemes influence thought and value judgments. If we examine how consciousness is being explained in the field of brain research, and the role of genes in the development of organism and moral behavior, we find that the influence of culture either is ignored entirely or explained as having a genetic basis (Damasio, 1994; Alexander, 1987; Wilson, 1998). E. O. Wilson's argument that as soon as the findings of genetic biology are universally understood the cultures of the world will abandon the mythopoetic foundations of their belief and moral systems and adopt western science as their new religion (1998, p. 264) represents yet another example of how root metaphors can frame the process of thinking in highly reductionist ways. In Wilson's case evolution is the root metaphor that leads him to equate the adoption of western science with cultural survival. That there are as many different cultural epistemes as their are different spoken languages, and that many of these epistemes encode both technical knowledge and moral awareness of the limits and possibilities of the cultural group's bioregion, makes the reductionist treatment of culture an even more serious matter.

As many environmental educators have acquired their primary body of knowledge in one of the sciences, or are dependent upon curriculum materials based on scientific studies, they unconsciously base their thinking (and the curriculum) on the same root metaphors that are taken-for-granted within different segments of the scientific community. That is, they reproduce in their teaching not only the root metaphors but also the silences and reductionist thinking of their parent field. One consequence is that some environmental educators are unable to help their students understand how the languaging patterns of a cultural group contribute to degrading the ecosystems that are the focus of the curriculum. The marginalization of culture as a major contributor to environmental degradation is matched by a collective silence about the nature of cultural practices that have a smaller environmental impact. Too often environmental education is a form of socialization to the eco-management

way of thinking that is predicated on the root metaphors of anthropocentrism, subjective/rational individualism, and economism.

Science has vastly improved our knowledge of natural phenomena and improved the quality of people's lives, But like Janus, the Roman God with two faces that look in opposite directions, science has played a major role in contributing to the rate and scale of environmental degradation that, on a local scale, is often the focus of environmental education. But the linkages between scientific discoveries, technological applications, and legitimating cultural values are seldom, if ever, addressed as part of the environmental education curriculum. Students, in effect, encounter a one-sided view of science where only the benefits are considered, which is likely to correspond to how Sagan summarizes how human progress is dependent upon science. According to him,

> Science alerts us to the perils introduced by our world-altering technologies, especially to the global environment on which our lives depend. Science provides an essential early warning system. Science teaches us about the deepest issues of origins, natures and fates--of our species, of life, of our planet, of the Universe....
>
> The values of science and the values of democracy are concordant, in many cases indistinguishable.

Sagan goes on to warn that "abandoning science is the road back to poverty and backwardness" (p. 41).

It is unlikely, given this list of how dependent we are on science, that environmental educators would dare to include a discussion of the other face of science--the one that has an equally long list of disruptive effects on both cultures and ecosystems. There is also the question of whether the education of environmental educators prepares them for engaging students in a more balanced discussion of the role of science in shaping today's world. Yet, this may be far a more important part of environmental education than the classroom lessons and field trips that focus on the characteristics and restoration of natural systems. Indeed, a strong case can be made that a sustainable future will depend, in part, upon understanding the

destructive and hegemonic face of science. Understanding that science has contributed to the environmental crisis, and to undermining the traditions of self-sufficiency of many cultural groups, should not lead students to turn against science. Rather, the need is for them to acquire a more balanced perspective--one that contributes to a public informed about the appropriate and inappropriate use of science. To put this another way, a more balanced understanding of science should lead to an awareness of when scientists are helping to translate their discoveries into technologies that will introduce fundamental changes into the fabric of cultural life. The public needs to be able to debate and be part of the decision making process when there is the possibility of these technologies introducing wide ranging consequences that cannot be fully predicted. The importance of democratizing scientific decisions can be seen in the public challenge to nuclear power and genetically altered foods.

An overview of the role of science in making possible the technologies that were the basis of the Industrial Revolution would provide students a more complex understanding of the cultural influences on the changes they study in their environmental education class. Many of these changes are currently being linked to synthetic chemicals introduced into the environment over past decades as a means of increasing productivity in manufacturing and agriculture, and in creating a more consumer dependent lifestyle. The discovery of DDT by Paul Muller, which led to his being awarded a Nobel Prize in 1948, is just one of thousands of examples of how science has contributed to the Industrial Revolution, which scientists are now connecting to global warming, the destruction of the ozone layer, and to the chemicals that are now altering the reproductive patterns of many species--including humans. This symbiotic relationship between science and the Industrial Revolution has changed the chemistry of natural systems to an extent that may not be reversible by the latest scientifically based restoration efforts. In effect, in the years ahead environmental education classes will involve the study of degraded environments left by a period in which scientific advances went unquestioned because the dominant way of thinking, among both scientists and the public, was based on the root metaphors of anthropocentrism, linear progress, individualism, and mechanism.

Recent scientific and technological advances, especially in such fields as biotechnology and artificial intelligence, hold out the possibility of even more radical changes being introduced into the world's natural and cultural systems. While there is disagreement within the scientific community about whether certain technologies should be introduced into public life, there is strong evidence that the traditional combination of deep cultural assumptions and corporate values will not deter some scientists from carrying forward their research, regardless of its cultural impact. For example, some scientists are now claiming that in a few years technology will have advanced to the point where parents will be able to choose the genetic make-up of their children, while other scientists are altering the genes of plants in ways that advance the industrialization of agriculture. Scientists are claiming that they are close to being able to change the genetic code of individuals in ways that will allow them to extend life hundreds of years. While there is a perception of benefits that justify each line of scientific research, such as eradicating the genetic basis of certain diseases, the negative effects are seldom discussed--especially by an informed public. To cite another example, the increasing control that pharmaceutical giants exert over scientific research in universities is largely unknown to the public. If the content of environmental education leaves students unable to understand the increasingly problematic merging of science, technology, and corporate culture it is very likely that when they become adults they will accept the scientists' claim that their research is essential to further progress.

Of the many cultural changes that can be traced to advances in science, two recent changes, by virtue of their scale and scope, are likely to have the greatest adverse impact on the world's cultures to adapt themselves in ways that ensures a sustainable future. Both areas of change appear as profoundly different, but closer examination reveals important connections. The globalization of a computer based mode of encoding knowledge and communication represents one of the sources of change. The other change can be seen in how science, both as an epistemology and as a source of a new root metaphor (evolution), undermines the mythopoetic foundations of the moral systems of different cultures.

The forms of knowledge and relationships that cannot be communicated through a computer (tacit, contextual, face-to-face intergenerational knowledge, as well as the culturally specific patterns of meta-communication) are essential to the moral and symbolic ecologies of human communities. On the other hand, the forms of knowledge that can be communicated through a computer (abstract and thus decontextualized information and data) reinforce the cultural patterns associated with print: individual perspective and interpretation, a conduit view of language that hides the cultural episteme encoded in the language that appears on the screen, and a subjectively-centered experience of temporality. In effect, computers reinforce the myth of the autonomous individual that was essential to expansion of the Industrial Revolution. Books explaining how computer technology represents the latest expression of the evolutionary process (Moravec, 1988; Stock, 1993; Kelly, 1994; Kurzweil, 1999) now complement current explanations of how genes create individuals and, by extension, the moral frameworks of different cultures (Alexander, 1987; Wilson, 1998). Unfortunately, the extension of the theory of evolution into a meta-theory that accounts for cultural developments is eroding, as part of the process of modernization, the foundations of other cultural ways of knowing. While not all of these cultural ways of knowing meet our standards of social justice or are ecologically sustainable, there are many cultures that have developed complex moral frameworks that strengthen mutual aid within communities and lead to lifestyles that have a smaller adverse impact on the environment. The bias of many scientists and environmental educators against considering the achievements of these cultures prompts me to cite scholarly studies that support my claim. Most noteworthy documentation can be found in the following: J. Stephen Lansing, Priests and Programmers: Technologies of Power in the Engineered Landscape of Bali (1991); Helena Norberg-Hodge, Ancient Futures: Learning from Ladakh (1991); Keith Basso, Wisdom Sits in Places: Landscape and Language Among the Western Apache, (1996); Frederique Apffel-Marglin (co-editor with PRATEC), The Spirit of Regeneration: Andean Culture Confronting Western Notions of Development. (1998). The undermining of cultural diversity, which the above studies also document, goes against one of

the design principles of Nature: the importance of diversity.

The dual face of science raises important questions for the leaders in the field of environmental education. Given that there are few science courses (at least in North American universities) that introduce future environmental educators to the complex interplay between culture and science (an interplay that becomes even more complex when non-Western cultures are considered), the question of where environmental educators are going to acquire the in-depth knowledge necessary for helping students understand the cultural roots of the ecological crisis become especially important. There is also the question of where environmental educators are going to learn that socializing students to eco-management approaches to solving environmental problems represent short term, stop-gap measures that seldom address the cultural practices that are changing the chemistry of the Earth's ecosystems. There is also the increasing important question of where environmental educators are going to learn about the pivotal role that some areas of scientific research play in the emerging academic/industrial complex, and how the traditional protocols that governed scientific research in the past are now yielding to the values of corporate culture (Press and Washburn, 2000).

The education of environmental educators, we can be certain, will not touch on these issues when they are exposed to a curriculum and pedagogy based on a constructivist view of learning. The assumption that students construct their own conceptions of the world fails to take account of the meta-schemata encoded in the languaging processes that are basis of thought, communication, and behavior. Depending upon the biographical distinctness of how students acquire the shared cultural schemata, their interpretations and decisions will represent various degrees of individualizing the shared patterns. And only in rare instances will students become explicitly aware of the cultural patterns that are integral to their self-identities and natural attitude toward everyday life--including the habit of keeping science and culture in distinctly separate conceptual and moral categories.

Approaches to environmental education based on the strategies of critical pedagogy

would seem on the surface to provide for a more explicit understanding of the connections between cultural assumptions and the science/technology practices that have contributed to such local environmental changes as the decline in bird populations and amphibians that students might study. Unfortunately, the problem with a critical pedagogy approach to environmental education, for both teaches and students, is that it is based on the same root metaphors (progress, individualism, anthropocentrism, etc.) that co-evolved with the Industrial Revolution. When thought and behavior is based on the assumptions encoded in the language of emancipation, which Paulo Freire, Henry Giroux, and Peter McLaren think should be universally imposed, the different cultural networks of mutual support and intergenerational knowledge and responsibility that represent alternatives to a consumer/technology dependent lifestyle are undermined. Nor are the meta-schemata underlying critical pedagogy able to represent cultural traditions in ways that take account of how some traditions are sources of empowerment and of morally coherent communities while other traditions should not have been constituted in the first place, or are too slow to change. This failure is especially important to incorporating an eco-justice perspective into environmental education in ways that takes account how the traditions of the commons of many minority cultures have a smaller ecological footprint.

Part of the answer to the question about how to broaden the knowledge base of environmental educators can be found by recovering the original meaning of the word "ecology," and using it as the root metaphor for framing the content of an environmental education curriculum (Bowers, 2001). For the early Greeks, the word "oikos" was used to refer to the routines and management of the household. The nineteenth century German disciple of Darwin, Ernst Haeckel, coined the word "oecologies" and used it to designate the new science of the relations between living organisms. This shift in the meaning of ecology, to use the modern spelling, separated the routines and management of the household (the realm of cultural beliefs and practices) from the study of natural systems. Environmental education, with few exceptions, has perpetuated this artificial separation--which leaves students largely unable to

recognize the fundamental changes that need to be made in the cultural assumptions upon which the relationships and management of the human household are based.

Understanding culture as an ecology has more significant implications than that of providing students an understanding of the symbolic foundations of the ecological crisis--which can also be interpreted as encompassing the crisis of the family and community in societies where hyper-consumerism has taken hold. One advantage of basing an environmental education curriculum on this expanded meaning of ecology is that it leads to studying the interdependent relationships and activities within the community that are not fully dependent upon consumerism. Understanding and learning how to participate in these community networks is the first step to breaking out of the cycle of environmental exploitation and consumerism that creates a phenomena not know in the natural world: waste materials that are not part of the metabolic energy exchange vital to all living entities. This cycle involves having to spend more hours working in order to pay for goods and services that families were less dependent upon in the past, which in turn takes time away from parenting and participating in the activities that sustain the sense of community. Learning about the different forms of knowledge and skills, including mentoring relationships, within a community that reduce dependence upon meeting needs through consumerism (which ranges from entertainment, food production, health care, to being able to make simple household repairs) should be an essential part of environmental education.

This awareness involves another shift in the metaphorical language that guides thought and behavior. Whereas the earlier suggestion was to broaden our understanding of ecology to include the human household in all its cultural dimensions, there is a need to borrow the metaphors used in the ecologically oriented sciences. The metaphors used in the following phrases--environmental restoration, wilderness and species preservation, and conservation of wetlands--highlight the double bind that exists in language used by educational reformers. As I point out elsewhere (Bowers, 1995, 1997, 2001), technocratic, neo-Romantic, and emancipatory genres of educational liberalism base their reform proposal on the same core set

of root metaphors that legitimized the Industrial Revolution--and now the digital phase of the world transforming process we are now entering. To reiterate: these basic root metaphors include viewing the individual as autonomous, change as a linear form of progress, and Nature as a resource that can be improved upon through rational design. Equally problematic is how basing thinking on these root metaphors leads to universalizing the liberal prescriptions for educational reform, thus ignoring that many of the world's cultures view the western educator's effort to foster an autonomous form of individualism and to base social change on the more widespread use of western technologies and expert systems as the most recent expressions of colonialization. In addition to these limitations of the liberal political vocabulary, it can also be faulted for framing how educational theorists view reform in ways that marginalize (indeed, treats as reactionary) the importance of understanding the patterns of interdependence within culturally diverse communities.

Making education part of the process of community renewal requires a more complex understanding of such words as restoration, preservation, conservation. Indeed, the struggle to preserve what has not been transformed into a monetized relationship requires the recognition that the most radical educational reforms today involve conserving (and renewing--which is a process of reform) the intergenerational traditions that meet the three basic criteria of eco-justice: not degrading the environment of the less politically powerful cultural groups, strengthening the non-commodified traditions within the dominant culture as well as the traditions (heritage) of minority cultures; and ensuring that "progress" does not reduce the viability of natural systems in ways the limits the prospects of future generations.

The curricular implications include fostering a critical understanding of how science and technology are being used to commodify ever more aspects of daily life, which in turn contributes to more toxic wastes being returned to the environment--most often the environment of economic and politically marginalized groups. An eco-justice oriented environmental education curriculum should also include helping students examine the ecological footprint of the non-commodified activities, forms of knowledge, and skills acquired through

mentoring relationships--as well as learning to participate in these aspects of community life. This suggestion may appear to be outside the legitimate scope of environmental education. But if environmental educators are to address the deep cultural roots of the double bind where the continued emphasis on a consumer dependent lifestyle, which is being globalized, threatens our long term survival they will need to take seriously the managing of the household (ecology--in its original meaning). This may require a more interdisciplinary approach to environmental education, which holds the additional promise of overcoming the idea that environmental educators are primarily responsible for addressing the ecological crisis.

Environmental educators need to take seriously the insights of both Confucius and Wendell Berry that if we are to rectify our relationships with each other and the environment, we must first rectify our language. And this means helping students clarify the connections between the various expressions of liberalism and the process of globalization that is accelerating the degradation of the environment. The rectification of language also needs to take on the challenge of clarifying the different expressions of conservatism--with the main focus being on the forms of conservatism that address eco-justice issues and the need for communities to become rejuvenated in ways that limit the "everything is for sale" mentality that has become so dominant in recent decades.

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