

# Complexity and Environmental Education

June 30, 2002 · *Emergence*

Carlos J. Delgado Díaz

J. Delgado Díaz C. Complexity and Environmental Education. *Emergence: Complexity and Organization*. 2002 Jun 30 [last modified: 2016 Nov 21]. Edition 1. doi: 10.emerg/10.17357.17cc12c8834f213bb13017e762b9510d.

By naming this article “Complexity and Environmental Education” I want to call the reader’s attention to the implications of the change of scientific paradigm for the analysis of a specific problem, environmental education, from the perspective of my own philosophical specialization.

Beginning in the second half of the twentieth century, a change has been occurring in the logic of scientific explanation of different branches of knowledge. This change has at its center the substitution of the simplifying paradigm inherited from modern classical science with another that takes into account the multiple interactions that occur in the processes studied. We have begun to understand the world in terms of dynamic systems, where the interactions between the constituents of the systems and their environment are as important as the analysis of those same components. The world has begun to cease being a group of isolated objects and is being presented to the mind and to knowledge as a reality of interactions, emergences, and becoming.

That paradigm shift has important consequences for our vision of the world, for knowledge, and for its social status. Independently of the deep changes occurring in special areas of science, changes in our very understanding of knowledge itself, its production, and its social reach are extremely important.

As the use of the term complexity is still diffuse, I will begin clarifying my interpretation of it. When I speak of complexity I distinguish, following Dr. Maldonado (Maldonado, 1999), three main approaches:

1. Complexity as *science* (the study of nonlinear dynamics in various specific systems).
2. Complexity as *method of thought* (the proposal of a method that overcomes the dichotomies present in traditional epistemology and that consists basically in learning to think relationally).
3. Complexity as *worldview* (the articulation of a new understanding of both the world and knowledge, an articulation that overcomes reductionism and takes advantage of holistic considerations emerging from systemic thinking).

These three approaches are complementary and intertwined despite the fact that, because it constitutes the scientific substrate for any methodological and worldview articulations and thus is at the heart of any paradigm shift, research into nonlinear dynamics is the basis of the other two. However, as a philosopher and researcher in the field of environmental studies, I am specially interested in the worldview scope of the new ideas.

From modernity to today we can distinguish three ideals of rationality that have been present in the production of scientific knowledge. First, classic scientific rationality, characterized by the absolute opposition between the subject and object of cognition and by the elaboration of a worldview constituted by objects separated in space and time. This worldview prevailed until the beginning of the twentieth century, when relativistic and quantum-mechanical thinking broke for the first time with the antinomic opposition between the subject and object of cognition by taking into account observation conditions and the observer’s intervention as constitutive elements of cognitive reality. The breakthrough caused by this second ideal of scientific rationality, however, was not total. Essential elements of classical thinking and worldview remained, particularly the notion of simplicity as an attribute of reality. It was only beginning in the 1960s that, thanks to advances in cybernetics and electronic mathematical calculators, and the so-called scientific-technical revolution, important unresolved scientific and practical problems—the problem of the environment in particular—triggered research into what we today gather under the common denominator of complexity.

I should mention that changes in ways of scientifically approaching the research object were not always accompanied by corresponding changes in the field of philosophical epistemology. Classical epistemology—with its exact differentiation of truth and error, of what is objective and subjective, of the subject and object of cognition—persisted in various forms until well into the second half of the twentieth century. This way of thinking finds its last representative in Karl Popper.

Breakthrough ideas occurred in both the dialectical tradition and the historical school of epistemology, both of which recognized the need to acknowledge the subject of cognition as contextualized, historically as well as culturally. However, these more advanced epistemological proposals were still not able to overcome the earlier and dichotomous canons of classical epistemology. For this reason, complexity thinking was initially considered by many philosophers to be a scientific theory important only for its content and by its research objects, and not for its particular cognitive nature nor its original way of formulating problems of cognition. From this scientific theory, however, there has emerged an epistemological reflection of

philosophical and worldview significance, linked to scientific debates around implications of the new concepts for issues pertaining to scientific responsibility, the scope of knowledge, and its objectivity. (Among the participants in these debates we highlight relevant scientists such as F. Capra, H. von Foerster, M. Gell-Mann, J. Lovelock, H. Maturana, I. Prigogine, R. Thom, and F. Varela.)

Even if we do not pretend to be exhaustive, it is nevertheless important that we attempt to answer the question: What is the worldview scope of the new theories, of the new emergent thinking? I will summarize it in four aspects:

1. Humankind's history and the history of knowledge, which seemed until very recently Parmenidean, have begun to turn increasingly Heraclitean.
2. The world is not zero-sum. Emergence is an essential characteristic of the new paradigm.
3. Complexity is not unique. Multiple complexities do exist.
4. The new scientific rationality has outlined in a radical and new way the problems of the artificiality of man's world and of his knowledge; of the value of knowledge, of its proper status, and the correlation among subject, subjectivity, and objective knowledge.

These aspects have special importance for reframing our understanding of the world, in particular the view that more or less reduces it to a specific group of simple and discontinuous entities.

Oft-repeated and always disturbing questions such as "What is the world?" and "What relationship do the world and human knowledge have to each other?" have been restated and they are being given new answers.

The nature of those answers is central to our understanding of the environmental problem and to outlining a direction for the environmental education of people living in contemporary societies. It is even more significant if we consider that the environmental problem, seen from a historical perspective, is one of the sources of the emergent complexity paradigm.

It is important to distinguish the epistemological level of complexity from the ontological one. If from an epistemological perspective the problem of complexity is about the knowledge of reality, in the ontological perspective we have before us the problem of the nature of reality. Both problems form an indissoluble unit, since the subject and object of cognition are functional epistemological categories. Complexity thinking, especially some of its most disturbing ideas such as autopoiesis, has forced us to restate the philosophical problems of the artificiality of man's world, the identification of being, and knowledge as a unique process. The dialectical thesis affirming that "there is no object of cognition without a subject of cognition" has now been deepened in the direction of the subject of cognition. "Cognition implies a subject that knows, and it doesn't have sense or value outside of this" (Le Moigne); or, as von Foerster (1998) has outlined, "an epistemology that takes account of itself," that is responsible to the interior of the subject of cognition, suddenly becomes necessary. (See also Maldonado, 1999.)

*The subject of cognition builds a knowledge of reality that is no other than that of his/her own experience of that reality, so what is necessary to know is the subject of cognition, enriched by the knowledge that has forged and his/her capacity to construct or to reconstruct reality. (von Foerster, 1998)*

It is not, therefore, a solely external affair, that of knowledge of an external reality, nature, environment, world. It is simultaneously an internal one.

This is a radical outline of the problem of the relationship between knowledge and value and one that we ought to consider. Knowledge is such in so far as the subject of cognition attributes some value to it. Thus reality is constructed through activity, where the subject of cognition constructs his or her experience of that reality through symbolic representations (outlines, letters, phonemes, etc.). In Bachelard's terms, "Nothing is given, everything is built"; or, if we prefer Machado's poetry, "Walker, there is no road, the road is made through walking" (Maldonado, 1999).

From the seventeenth to twentieth centuries we have moved in philosophical epistemology from the notion of an absolute and transcendental subject of cognition separated from the object of cognition, toward the idea of a relative (historical and social) and specific subject of cognition. Now we have begun to talk about the necessity of understanding the subject of cognition as a reflexive entity that accounts for itself. That means that there is no unsurpassable barrier between knowledge and value; that knowledge is not only a value in itself, but rather it acquires sense as knowledge by being a value. I understand that this is an extremely delicate matter, because it affects almost all traditional notions of the objectivity of knowledge. What is important is not to substitute the unsurpassable barrier that separated the objective from the subjective by a bridge of absolute subjectivism. What we need is to understand the artificial, constructed nature of the products of human activity (in this case, of that supreme product we call knowledge, which is now seen to be historic-social).

Our knowledge of the world is a constructed value that allows us to create a representation of that world, but it is not the world in itself. It is a human product that has its origins in human subjectivity. Modern thought excluded subjectivity and built an objectivity based on the exclusion of the subject of cognition. Thus, it endowed knowledge with extraordinary attributes of power and obligation. For too long we thought that the world was just as our knowledge—historically and culturally limited—affirmed that it was. What we now need is to consider the presence of subjectivity in all knowledge. However, this has an extremely important philosophical consequence: If man's world is an artificial world, constructed from knowledge, and if that knowledge is a result of the integration of the subject of cognition and the object of cognition in cognitive acts (which gain significance for that subject of cognition from the involved values), then it is not possible to affirm an objective cognitive relationship that excludes the subject of cognition and transcends it.

If we examine some of the definitions of the environmental problem, we will see that these epistemological debates are not fruitless. One of the most frequent definitions of the environmental problem considers it a problem of the relationship between society and nature. This is a very common definition that takes into consideration the damage that man's actions cause to the natural systems of the environment. However, it is sufficient to ask ourselves "Has the environmental problem always existed?" to become convinced that it is not a problem of the relationship between "society" and "nature," but rather a problem of the relationship between a certain historical type of society and its environment. This precision is not trivial at all, because for a long time in the socialist world it was thought that the environmental problem was the exclusive problem of capitalist society. The fact is that both opposed political systems of the twentieth century, capitalism and socialism, have harmed the atmosphere equally. So this has introduced an important correction in the historical type of society considered, western society. But what really is western society?

Western society is a diverse and integral cultural and social phenomenon. It has become the predominant society in the contemporary world, based on two kinds of influence, material and spiritual. Material influence is associated with the political and economic relationships of dominance and colonization imposed on the world with modernity. Spiritual influence has to do with the generalization of a certain view of the world, the extension of an instrumental relationship with nature, and a unified vision of the natural world (as opposed to a view of the social world with man as its central dominant entity).

If we look carefully, however, the environmental problem cannot be defined, as is often suggested, either as that of the relationship between society and the environment, or as that of the relationship of a certain type of society with its environment. It never occurs to me to think that man doesn't damage the natural environment; there is sufficient proof of that at each stage of modern life. But material damage to the environment is a consequence of our spiritual consideration of what that environment is and of what it means to those of us immersed in western culture. The environmental problem is not the problem of man's relationship with his environment; it is above all the problem of man's relationship with himself. If we are not able to understand that cultural dimension of implicit subjectivity, we will hardly be able truly to understand this problem.

It is from a relationship of cognitive dominance and exclusion, from a dichotomous idea of the world that divides it into a natural and external part and an internal and properly social part, and from a notion of objective knowledge that forces a subordination of obedience that the development of a material model of predatory relations within the environment became—and still becomes—possible. Although it is important from the practical point of view to control predatory practices in their wilder and more destructive forms, it is extremely important from the educational point of view to pay attention to the epistemological and cognitive foundations of those instrumental predatory models. Our idea of the world must be revised and, with it, the absolute dichotomy between nature and society as opposed ends.

Man and the natural environment, and society and the natural environment, constitute an integral unit. We do not have here a relationship between external entities. Rather, we have a problem internal to man's world. It is the cultural world of a historical type of man that has caused this problem and that reproduces it every day. It is of no value to try to endow man with positive knowledge of the dynamics of nature, as there is no value in the breakthroughs that our models of productive interaction with nature cause if we don't take into consideration as a central matter the cultural limits of that provocative subject of environmental damage.

In my opinion, environmental education must be thought of as overcoming cultural limits and should be directed specifically to consideration of the cultural ways in which we perpetuate the dichotomous and reductionist idea about nature as an external environment. This cultural mindset persists in western society, adopting proper "faces" in various disciplines, especially in economics, politics, and ideology.

Without a doubt, the environmental problem is a social problem of a cognitive nature, economically, politically, and ideologically. Overcoming a problem like this cannot be thought of simply as a change of attitudes, as an inculcation of ideas, of conceptual clarifications, or as either a forging of abilities or a modification of sensibilities, although all these aspects must be included in the total process. The predominant focus today in environmental education makes it clear that the environmental problem has sources within the cognitive and social order that must be revealed. Educational tasks should be directed toward overcoming these deeper obstacles. Otherwise we won't be able to achieve the necessary human change.

In short, at the foundation of the environmental problem there are some epistemological presuppositions that we still acritically assume as if they were unchangeable truths. They deeply condition material predatory attitudes in our spiritual constitution and can be summarized as follows:

1. The absolute delimitation of the subject and object of cognition that is a legacy of modernity and conditions humankind's social perception of the relationship with the environment as one of opposed ends in an absolute way. This opposition led to the articulation of a simplified idea of the natural world as an opposed, passive, and simple entity, easy for man to understand and reproduce. This model's conceptual simplification has prevented man from capturing the wealth of natural interactions, and has facilitated his evaluative impoverishment by viewing nature only from the angle of some of the human interactions with it, particularly as an economic resource.
2. The epistemological justification of scientific truth and science as exact and objective knowledge maintained since the seventeenth century and based on the exclusion of subjectivity and of the subject's absolute opposition to the object of cognition. Thus, man was considered to possess knowledge able to guarantee him domination over natural processes, an idea that is at the foundation of depredatory technologies of the natural environment. That is, the destruction and material impoverishment of the natural environment by man have as their epistemological antecedent serving as their base the destruction of natural integrity and its impoverishment in scientific theories (Capra, 1996). The idea of man's domain over nature is based on this impoverishment of the world.
3. Overcoming the impoverishment of the world by the subject of cognition demands recognition of the participative character of reality. Man's world is an artificial one in which nature is incorporated. Consideration of the participative character of reality allows us to understand what is human and what is natural as a totality and to consider overcoming the problem of the environment as "humankind's problem."
4. Recognizing the participative character of reality, integrated by the subject and the object of cognition, indicates that knowledge is value and its objectivity includes the evaluative moment. Science and morals are indissoluble parts of the objectivity of human knowledge in the participative reality in which they are integrated. The reality of the evaluative dimension in knowledge is not an external attribute coming from society and from social requirements. It emanates from the bases of science and forms part of knowledge as a social construction. Values are constitutive of activity and therefore of the structure of science and its product; scientific knowledge is not an absolute and superior value, but is nonetheless a value and as such must be subjected to social and cultural scrutiny.
5. Man's understanding of the artificiality of his relationship with the world is a decisive step in overcoming objectivism in scientific approaches, which has led from an epistemological point of view to environmental damage. This understanding can serve as a basis for overcoming the strongest cultural barriers that environmental education encounters in western civilization. These are:
  1. the idea of the absolute legitimacy of knowledge,
  2. its pretended independence with regard to human values, and
  3. the legitimacy of objective knowledge to guarantee man's supposed domination over nature.

Each of these five erroneous epistemological notions has had its specific manifestations and its own impact on economic theory, politics, and ideology. Among these, as a synthesis we can mention:

- The excessive dimensioning of economic value in political economies of all types, and consequently in contemporary man's way of thinking. The environmental problem cannot be solved without changing the patterns of economic construction and development that have followed industrialization in the nineteenth century. Environmental damage manifests itself in social and economic environments as the realization of the idea of man's domination over nature and also over other social environments that should be assimilated and thus disappear.
- The extension of the ideas of domination and exclusion to politics has become the general ideological, political, and spiritual instrumentation of dominance of some people by others. Cultural intolerance to the diversity of human environments is a specific social manifestation of the environmental damage caused historically by man to himself. This intolerance has included political subordination and the implementation of economic systems that harm human diversity. The impoverishment of the natural and social environment has been the final result of this tendency.
- The dominant idea in ideology that a unique or preferable model of development exists that all societies should adopt, an idea that has led to spiritual justification of the extermination of some people by others. According to this logic there are people and ways of human development that should not exist.

Environmental education must include a deep change in the interior world of the subjects of cognition and a modification of their material relationship with other forms of life and natural processes. The educational task is dual: It demands a change of mentality and a transformation of ways of living.

It is not enough to modernize environmental education so as to actualize us with regard to ecology or alert us to predatory technologies. Environmental education must provide man with an integrative theoretical framework that allows the subjects of cognition to orient themselves within a complex system of cognitive, economic, political, and ideological interactions. Western man's biggest impoverishment is an evaluative one. In the course of the development of western culture, historical man has lost the capacity to produce multiple evaluative judgments; evaluation has been divided into several compartments that make us see only the economic side of things, or the human side, or the natural side, or the social one, or the political one, and so on. Economically understood value frequently subordinates the other values in human evaluations.

Environmental education must be formulated as an education in values that contributes to restoring the evaluative integrity that western man has lost. This includes integral consideration of the natural and human environment, and reconsideration of the predominant cognitive relationships that stem from modernity up to the twentieth century. It includes the rebuilding of morals within the system of knowledge, and the overcoming of modernity's schematicism about the subject and the object of cognition as absolutely opposed ends of knowledge. It includes education about a new worldview based on the construction of a different model of cultural man.

The final result of this transformation must be the intellectual transition from historical man to ecological man. The essential task of environmental education is the reconstruction of the human integrity lost in the process of historical man's formation.

The recovery of that lost integrity (to do which we need to overcome the dichotomies between society and nature, man and environment) will be possible only by means of a cognitive and material effort. The first intellectual step can be made by an educational effort that reestablishes the evaluative integrity that historical man has lost in the process of his social and economic homogenization. This will be followed by the active and transforming recovery of social and economic diversity by ecological man.

## References

1. Bachelard, G. (1978) *The Philosophy of No*, Buenos Aires, Argentina: Editorial Amorrortu.
2. Capra, F. (1996) *The Web of Life: New Scientific Understanding of Living Systems*, New York: Anchor Books.
3. Foerster, H. von (1998) "For a new epistemology," *Metapolítica*, 2(8).
4. Maldonado, C. (1999) *Visions about Complexity*, Bogotá, Colombia: Santa Fé.