Darwin, evolution and progress

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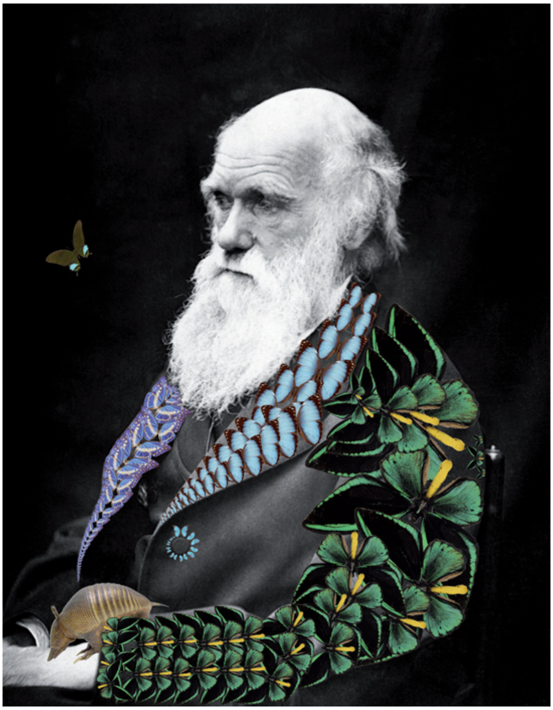

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Darwin, Evolution and progress

Since the publication of *The Origin of Species*, 150 years ago, and the popularization of Darwinism, a lot has been said about Darwin's ideas and their implications in various sciences. One of the most revolutionary aspects of Darwin's concept of Evolution is that the adaption of species to local contexts occurs based on an evolutionary process without direction or intent. However, Darwin's Evolution is a metaphor frequently used to support Western society's belief in Progress as a process of intentional development towards a better world (Gould, 1988). In the text I aim to reflect on Darwin's legacy regarding these two forms of understanding the world – Evolution versus Progress – which are often rivals and lay the base of diverging proposals for the intervention in natural and social systems. I will start by briefly indicating how the concept of Darwin's Evolution is used to explain the emergence of complex systems so that further on I can compare it to the modern paradigm of development based on determinist systems.

The concept of Darwin's Evolution gave us a world without a creator or engineer. The changes which happen to species are not the result of a plan or intention, they are not more capable *a priori*, and are not moving towards a perfect world. On the other hand, the appropriation of Darwin's concept as Progress leads us to believe that evolution advances gradually in the direction of greater perfection. In the vision of Progress, the engineer is replaced by evolution's own mechanism. The world we live in is seen as the best of possible worlds, in which other worlds were eliminated by the "executioner" of natural selection (Gould, 1988). This world obeys the laws of nature and believes that there are answers with greater success than others *a priori* in order for us to adapt to an environment that is insensitive to our will.

François Jacob (1989), in his book *The Possible and the Actual*, uses a curious metaphor for biological evolution without an engineer: it would be great if we did photosynthesis, that way we would not need to work to obtain energy, we would just have to stay in the sun. Why don't we? Because somewhere on the path to evolution, this solution stopped being possible. If we have to imagine a Creator, the most appropriate metaphor for evolution is not one of an engineer, but of a gadgeteer who improvises with what he has at hand as one does bricolage, transforming arms into wings, legs into fins, using the materials available for new uses. The success of a gadgeteer is in always having materials available to reuse, in the proverbial sense of "he who saves what has no worth will always have what he needs". But there is still another important consequence in replacing the engineer for a gadgeteer: the second does not have a plan, he improvises, and therefore, the world which he produces is not the best of possible worlds. It is simply a world that functions (or goes on functioning) in the most varied contexts. The diversity of contexts selects a diversity of possible responses in which various solutions can coexist. In this sense, a certain ecological niche can be occupied by various species with different life strategies, from parasitism to free living, from rapid growth to slow, from mass reproduction to unique descendants, from specialists to generalists. The "game rules" which determine what is possible are not the universal "laws of nature", but contextual. For example, some species of fungus invest in sexual reproduction in situations of food scarceness and in nutritionally rich environments they just grow. The driving force of evolution depends as much on the existence of diversity of solutions to deal with environmental challenges as well as on the existence of barriers (geographical, temporal, seasonal, ethological or others) that limit the contexts to which the species adapt. The process of the creation of species – speciation – is a reflex of this creating force of diversity and barriers. Where a species begins and ends is a constant debate subject in the scientific world, but it is unanimous that species exist as groups of delimited organisms by some sort of criteria[1]. According to the evolutionary concept of species, these are defined as groups of organisms isolated genetically from others that just exchange genetic information amongst themselves.

The barriers lead to the existence of species with colective identities, but the coexistence of these identities forces them to relate. Again, there are diverse forms of possible interaction, from competition to altruism, that are not always determined just by the species but also by the context. For example, certain funguses can behave as symbionts or tree parasites, according to the health state of the plant. The interaction among species also conditions the evolutionary path of each species, a process which is called co-evolution. This concept was highly popularized in the evolutionary study of predators and prey, but can be stretched to the abiotic environment, since the modifications of living beings are capable of modifying the environment itself and affect the entire ecosystem (as plants notoriously did with the production of oxygen). Due to environmental changes the adaptation of species never results in a perfect world, because the species live in environments of constant change. Change rhythms are not constant and periods of certain stability can be interrupted by catastrophic events (Gould, 1988). For all that has been said, Darwin's evolution without a path of various groups of individuals in delimited contexts and with various possibilities of interaction in a world in constant change results in a complex system. Consequently, the paradigms of Evolution based on Darwin's idea are not deterministic, but enriched of explanatory power regarding complex systems: we can explain the evolutionary path of a species, but we cannot predict what will happen in the future. The connecting link of evolution is its history and game rules that limit the universe of possible

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[1] Species are not "natural" groups. The concept of species is a human construction and various notions exist according to schools of classification and operative criteria (Serra, 2005). The biological concept of species defines it as groups of individuals that reproduce amongst themselves and originate fertile descendants. However, this criteria cannot be operated on living beings that reproduce asexually or para-sexually (ex.: fungus, bacteria…), or possess cultural and physical barriers that led them to reproduce in controlled environments (ex: dog and wolf, a male Saint Bernard and a female Chihuahua, among others). The evolutionary concept of species is one of the "common denominators" used by the scientific community.

solutions, but the final result of evolution is unpredictable, because it does not depend on progressive adaptation of the species to the environment but on the co-evolution of species with the environment.

In "Development Betrayed", Richard Norgaard (1995) compared the concept of co--evolution to the concept of Progress which is at the base of development standards promoted by Western societies. The concept of progress has its roots in deterministic sciences that consider the world static and determine mechanic models capable of prediction when the "laws" that govern systems are decoded. The myth that we can progress towards a determined path, for example, sustainable development, is based on the assumption that we can control nature through science and get effective governance models based on rational social organization. According to Norgaard, the premises to development deem it to failure, for not recognizing that reality results from the co-evolution of ecological and cultural systems, which are complex and non deterministic. If we want to have new ways of thinking about the future, we have to look at the world with the eyes of complex sciences. To further explain this point of view, one of the examples presented by Norgaard is the co-evolution of plagues, pesticides, institutions and policies of the United States. Before World War II there were only inorganic pesticides (ex: sulfur) and some of the products in the market were not efficient. The regulation emerged as a way to protect farmers from false publicity and the consumers from dangerous contaminants in the food, while easing the development of new chemicals on behalf of the industry. In the 1940's a new type of pesticides was discovered: organic (ex: DDT), which initially were very effective and so widely used as opposed to the inorganics. But these new chemicals created resistance in insect populations in a few years, and the problems started. The reemergence of plagues occurred when the application of chemicals stopped and other plagues emerged to occupy agroecological niches unoccupied by the initial species. The response of the agroengineers and the chemical industry to these problems was to recommend more applications of pesticides. Despite entailing more economic costs, this recommendation made sense to the eyes of individual farmers that saw no other choice, but, collectively, caused more problems to resistance. Some researchers presented proposals of integrated protection programs based on ecosystemic approaches that included crop rotation, biological control and other measures applied in a coordinated manner; but these programs were only adopted by a minority of farmers. At the time when scientific information of the dangerous effects of organic pesticides on the environment was getting bigger, scientists and activists stimulated the environmental conscious which led to a new regulation to protect the environment and the health of rural communities. These more demanding regulatory requisites slowed the response of the chemical industry to produce new and more effective compounds due to administrative procedures imposed by environmental institutions. These delays in the development of new products led to an increase in their cost. Few companies managed to support the research costs and operate under imposed norms, which led to the restructuring of the industrial fabric in few companies of bigger dimensions. The new pesticides produced were less toxic to people, but more expensive and demanded more care and knowledge to apply them. The farmers managed to buy these products when the price of agricultural goods was high, in the beginning of the 1980's they were desperate when there was a break in prices. It was during this time that the Department of Agriculture supported the implementation of integrated protection programs, but the adherence to these programs is still limited and the agroecosystems were so modified that they cannot simply stop using pesticides entirely. It is evident that at the beginning of pesticide application, nobody could predict these environmental, social and economic problems. But in this case it is also evident that the responses of the institutions did not occur in a direct way to the problem, but according to political interests of those affected by the problem, from the industry to the environmentalists, which according to "the game of the possible» culminated in an indirect response which influenced the evolution of plagues and pesticides.

The difference between the aspirations of modern development and its achievements can be explained through the co-evolutionary paradigm, where the degradation and scarceness of natural resources, the scientific inability to give answers, the public sectors' inability to deal with bureaucratic obstacles derived from competing political interests and with ethic, cultural and religious diversity, reflect that the application of deterministic approaches to complex systems are condemned to failure. The crisis of modernity can be interpreted as symptoms of inadaptation to ecological and cultural systems, since the environmental crisis are, in a final analysis, crisis of social organization and cultural character.

The deterministic approaches are established on the assumption that there are universal ways of solving problems through science which are independent from contexts, and therefore legitimize centralised answers based on expert knowledge scientifically recognised which led to the homogenization of local contexts by imposition, sometimes by force, of valid answers *a priori*. The barriers that support the diversity are seen as obstacles to this hegemonic universalisation towards an ideal of unique progress. On the contrary, the co-evolutionary alternative legitimises plural approaches, decentralized and more contextualised. Instead of selecting *a priori* better solutions, the co-evolutionary paradigm opens political spaces to the participation of forms of scientific and traditional knowledge towards decision making. The co--evolutionary paradigm of Richard Norgaard is in its essence, emancipatory, because instead of substituting a legitimate form of knowledge by another without altering the hierarchy of powers, it favours the distribution of power. This conceptual evolution does not imply the destruction of deterministic approaches to contexts where they are well adapted as certain areas of chemical engineering, physics, biology and economy, among others. It simply defends that they cannot apply deterministic approaches to complex systems and hope for success.

The co-evolutionary paradigm as a model of development raises a series of questions. Which are the criteria to decide and intervene in complex systems when we know that the result of our actions is unpredictable? How do we create a space for dialogue and understanding among forms of distinct knowledge and uneven powers? The benefit of co-evolution as an alternative paradigm is not the best way to answer these questions, but it is a starting point, the destitution of our cosmic arrogance (Gould, 1988), the unique solutions, the legitimisation for a participative management of resources, the application of alternative pedagogies, like feminists, for the redistribution of power (Buchy, 2004). If there are no correct ways to understand the world, the best is to constantly submit science to the scrutiny of skeptic inquiry and maintain an open mind to evolve in our ideas. This is the most important legacy Darwin could have left us.

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