sLAB (Strategic Innovation Lab)

2015

Extending Deacon's notion of teleodynamics to culture, language, organization, science, economics and technology (CLOSET)

Logan, Robert K.

Information **2015**, *6*, 669-678; doi:10.3390/info6040669

OPEN ACCESS

information

ISSN 2078-2489

www.mdpi.com/journal/information

Article

Extending Deacon's Notion of Teleodynamics to Culture, Language, Organization, Science, Economics and Technology (CLOSET)

Robert K. Logan [1,2,3]

[1] Department of Physics, University of Toronto, 60 St George St, Toronto M5S 1A7, ON, Canada; E-Mail: logan@physics.utoronto.ca

[2] Book and Media Program, St. Michael's College, 81 St Mary St, Toronto M5S 1J4, ON, Canada

[3] Strategic Innovation Lab, OCAD University, 100 McCaul St, Toronto M5T 1W1, ON, Canada

Academic Editors: Mark Burgin and Wolfgang Hofkirchner

Received: 26 August 2015 / Accepted: 13 October 2015 / Published: 16 October 2015

Abstract: Terrence Deacon's (2012) notion developed in his book *Incomplete Nature* (IN) that living organisms are teleodynamic systems that are self-maintaining, self-correcting and self-reproducing is extended to human social systems. The hypothesis is developed that culture, language, organization, science, economics and technology (CLOSET) can be construed as living organisms that evolve, maintain and reproduce themselves and are self-correcting, and hence are teleodynamic systems. The elements of CLOSET are to a certain degree autonomous, even though they are obligate symbionts dependent on their human hosts for the energy that sustains them.

Keywords: culture; language; organization; organization; science; economics; technology; teleodynamics; morphodynamics; homeodynamics; thermodynamics; organism; obligate symbiont

---

1. Introduction

Terrence Deacon [1] in his book, *Incomplete Nature: How Mind Emerged from Matter* (IN) attempts to develop a scientific theory of how properties such as information, value, purpose, meaning, and end-directed behavior emerged from physics and chemistry. He tries to "understand life, then sentience, then the human mind" ([1] p.466) in terms of teleodynamics.

Deacon in IN introduces the following three nested levels of the dynamics and the organization of matter:

(1). **Homeodynamics or thermodynamics**, the lack of organization or the dynamics by which matter dissipates order or organization.

(2). **Morphodynamics**, by which self-organization can emerge as the result of the interactions of two homeodynamic or thermodynamic processes, as is the case for the emergence of hexagonal Bénard cells when a thin liquid is heated from its bottom surface. These cells accelerate the flow of heat from the bottom surface of the liquid to its top surface. Morphodynamics is not self-maintaining but eventually dissipates, once the two thermodynamic processes have run their course. Once the temperature gradient at one of the surfaces of the thin liquid is removed the Bénard cells collapse and dissipate.

(3). **Teleodynamics** is the result of the interaction of two morphodynamic processes that creates a system that emerges and acts in its own self-interest. To understand the origin of life, Deacon considers two examples of morphodynamics, namely the autocatalysis of organic chemicals suggested by Stuart Kauffman [2] and the self-assembly of the crystal like structures of cell membranes. It is postulated that the byproducts of these two self-organizing morphodynamic process, fortuitously, are the raw material for the other's morphodynamic self-organization and, as a result, these two morphodynamic processes reinforce each other and combine to form a teleodynamic system. Self-assembly is an exothermic process and auto-catalysis is an endothermic one [3].

According to Deacon, life emerges as a result of a higher-order reciprocal relationship or interaction between the self-organizing morphodynamic processes of autocatalysis and the self-assembly of the cell membrane that create a system, a living organism, with a sense of self that acts in its own self-interest. He also argues that sentience and mind also represent teleodynamic processes that emerge from the higher-order reciprocal relationship of morphodynamic processes, which in turn emerge from the higher-order reciprocal relationship of thermodynamic processes.

Deacon then suggests that a living organism is a teleodynamic system that operates in its own self-interest and as such it is "self-creating, self-maintaining, self-reproducing individuated systems" ([1], p.325). While there are some that are critical of Deacon's approach, few would disagree that living organisms are "self-creating, self-maintaining, self-reproducing individuated systems".

In this paper, I will explore the thesis that culture, language, organization, science, economics, and technology (CLOSET) are also teleodynamic phenomena by showing that they, like living organisms, are also "self-creating, self-maintaining, self-reproducing individuated systems". This paper does not attempt to justify Deacon's approach but rather attempts to extend it to include the members of CLOSET.

Culture, **L**anguage, **O**rganizations, **S**cience, **E**conomics and **T**echnology are activities that behave like living organisms that self-regulate, self-reproduce, self-correct and self-maintain themselves with the one exception that as obligate symbionts they depend on their human hosts for energy, but they assist their hosts acquire energy and do work. This is why I think that culture, language, organization, science, economics and technology represent teleodynamic processes.

The elements of CLOSET parallel the processes of living organisms as they also undergo a parallel form of Darwinian evolution of descent, modification and selection [4]. And, like living organisms, they have a telos in that they fit Deacon's ([1], p.235) definition of a teleodynamic system, in that they are "self-creating, self-maintaining, self-reproducing, individuated systems".

2. Language as an Organism

Morten Christiansen [5] has argued that human language can be "construed" as an organism that evolved to be easily learned. Terrence Deacon [6] in his book *The Symbolic Species* makes a similar argument.

In my book *The Extended Mind: The Emergence of Language, the Human Mind and Culture* [7], I incorporate the Christiansen/Deacon hypothesis that rather than considering Chomsky's Universal Grammar as magically hard wired into our brain it makes more sense to consider language as a living organism, an obligate symbiont (a parasite, but a good one), that evolved to make language easy to acquire. This also gets around Chomsky's claim that hard wiring is the only way to explain why it is so easy for children to learn language despite the poverty of stimulus. Grammar is universal because human cognition is universal.

The linguistic competence of each individual person represents an organism with its own unique semantics and syntax, which can communicate only with members of the same language species. All those possessing an English organism can communicate with each other. The set of all English organisms form the English language species, which is generally referred to simply as the English language. The same is true for all the other human languages of the world. We regard the English language facility of each individual as an organism. We regard the English language as the species of the individual English language organisms and consider all the individual language organisms as conspecifics.

3. Is Culture Also an Organism?

In the *Extended Mind* [7] I further postulated that since culture, like language, evolved like an organism that was easy for the human mind to grasp and hence it gave rise to Universal Culture (UC), just the way language evolved in such a way as to give rise to Universal Grammar (UG). It is the universality of human cognition that gives rise to both UC and UG. The arguments for the existence of UG that Chomsky [8] developed are more or less accepted by the entire linguistic community, although many do not accept his notion that we are hard wired with UG. The argument for the existence of UC, on the other hand, is less well known but just as compelling as the argument for the existence of UG.

Lee Cronk [9] argues that the great diversity of cultures is perhaps an illusion because anthropologists are biased to look for differences rather than similarities. Languages also look very different from each other, but they share a Universal Grammar according to Chomsky and most linguists. Cronk [9] suggests that maybe the same is true of culture. He cites Donald E. Brown's book *Human Universals* [10] and in particular the chapter titled "Universal People", which details universals appearing in everything from the details of language and grammar, to social arrangement, to the ubiquity of music, dance, and play. The list includes some surprises. Every society has gossip, all societies understand the idea of a lie, they all have special types of speech for special occasions, they all use narrative, and they all have poetry with lines that take about three seconds to say. Men are everywhere on average more aggressive and likely to kill than women, though individual men and women do differ significantly from the average. Everyone has taboos on certain statements and certain foods. All societies have some sort of music and all are at least aware of dancing (though it is prohibited in some of them). Remarkably, everyone has children's music.

4. The Culture of Each Individual in the Society is an Organism

When we speak of culture as an organism, we must decide if we are speaking of the culture of the whole society or of individuals within the society.

> People learn as individuals. Therefore, if culture is learned, its ultimate locus must be in individuals rather than in groups… If we accept this, then cultural theory must explain in what sense we can speak of culture as being shared or as the property of groups…and what the processes are by which such sharing arises.
>
> —Ward Hunt Goodenough [11]

Based on this insight of Goodenough, we will assume that the culture of each individual of that group is an organism and that the culture of the society as a whole is a species composed of the culture organisms of each member of the society that are therefore conspecifics.

5. The Co-Evolution of Science, Technology, Economics and Organization

The evolution of **technology** follows a pattern similar to that of living organisms, as has been pointed out by a wide variety of authors including Basalla [12], Cziko [13], Mokyr [14] and Vincenti [15].

Basalla [12] cites three basic analogies between technological and biological evolution. The first is the fact of the great variety of both biological organisms and technological tools. Basalla cites the fact that the U.S. Patent Office granted approximately 4.7 million patents between 1790 and 1988, the date of the publication of his book *The Evolution of Technology*. As he put it: "The variety of made things is every bit as astonishing as that of living things".

Basalla's [12] second point is that technology evolves through a process of descent and modification: "Any new thing that appears in the made world is based on some object already in existence". He cites many examples of how innovative technologies borrowed significantly from earlier technologies, citing the cotton gin, the electric motor and the transistor as three examples.

The third point that Basalla makes is that technologies survive through a selection process by which a society chooses a particular technology from a large number of variations for incorporation into its material life.

Finally, I cite my own work in which I too saw the evolution of technology as analogous to that of living organisms:

> Cognitive tools and physical technology are two resources at the disposal of human innovators, and the needs or demands of society are often the motivating force. Necessity is the mother of invention, yet invention does not occur in a vacuum. All of the previous innovations in a culture provide the resources, both cognitive and physical, for the next level of innovation. The previous innovations also contribute to changes within the socioeconomic system that give rise to new social demands. Each new invention, technological innovation, or discovery gives rise to new technical capabilities, new cognitive abilities, and new social conditions. These then interact with the existing economic, political, social, cultural, technical, and cognitive realities of the culture to set the stage for the next round of innovation. Thus, technological change in

> our model is part of an ongoing iterative process. It began with the inception of Homo sapiens and continues to this day at an ever-quickening pace.
>
> —Robert K. Logan [16]

Science is another symbol-based activity unique to humans, which also propagates its organization and evolves like a living organism. The mechanism for the propagation of science's organization is what Thomas Kuhn [17] termed normal science. Every success in science gives rise to a paradigm, which is articulated and applied to as many phenomena as possible. This is the mechanism of descent. Once a paradigm fails to provide a satisfactory description of nature a period of revolutionary, science begins with the search for a new paradigm. This is the mechanism of modification. If the new paradigm provides a satisfactory explanation to the science community by providing replicable results, a new round of normal science begins. This is the mechanism of selection. Science propagates its organization through normal science and evolves by descent, modification and selection just like living organisms. The analogy between the Darwinian evolution of living organisms and the process of descent, modification and selection in Kuhn's model led him to cautiously conclude at the end of his analysis of scientific revolutions the following:

> The analogy that relates the evolution of organisms to the evolution of scientific ideas can easily be pushed too far. But with respect to the issues of this closing section it is very nearly perfect… Successive stages in that developmental process are marked by an increase in articulation and specialization. And the entire process may have occurred, as we now suppose biological evolution did, without benefit of a set goal, a permanent fixed scientific truth, of which each stage in the development of scientific knowledge is a better exemplar.
>
> —Thomas S. Kuhn [17]

Economics is another symbol-based activity unique to humans, which also propagates its organization and evolves like a living organism. The original economy of human kind was hunting and gathering. Gathering evolved into agriculture when it was observed that certain nourishing plants could be easily cultivated. Hunting evolved into pastoralism when it was realized that certain animals could be domesticated. Primitive tool-making used for hunting and gathering evolved into handcraft manufacturing, stimulated by agriculture and pastoralism. The coordinated hunting and gathering led to food sharing, and from there it evolved into a key aspect of the human economy, namely local trading within a clan and from there trading between clans. With agriculture and pastoralism, trading between local clans evolved into trade between clans living in different ecological zones, which in time evolved into the manor system. The evolution of the economy became closely linked with technology, as tools were developed to improve the efficiency of agricultural processes and the processing of food. Other technologies contributed to the evolution of economics such as weaving, pottery, woodworking and metallurgy. As the scale of manufacturing increased, the economy of the town and the burgher emerged. This led to capitalism to finance larger and larger manufacturing enterprises. The next technological breakthrough of the rotary action steam engine led to the Industrial Revolution and a major discontinuity in the evolution of the economy.

Finally the emergence of electric media led to a new stage in the evolution of the economy, namely, the Information Age. With each new stage in the evolution of the economy, structures from the previous

period are incorporated into the new economic order. Capitalism was preserved, from its beginning in the burgher economy through the Industrial Revolution into the Information Age, with most of its feature in place. Even socialism retained many of the features of market capitalism and could easily be seen as state capitalism. The evolution of the economy is closely aligned with the evolution of technology so that changes in the economy give rise to new technologies and, vice-versa—new technologies give rise to new economic practices. Economics and technology co-evolve and they in turn co-evolve with organization or governance to which we now turn our attention.

An **organization** in the sense of a group of individuals working together with a common objective is another symbol-based activity unique to humans, which also propagates the way it is organized from day to day from year to year and in some cases from century to century. The way an organization is organized can be thought of as its governance, so organization and governance basically overlap. Examples of organizations include political organizations like countries, states or provinces, cities, political parties, organized religions, companies or firms, associations, societies, clubs, and even right down to the level of families. They reproduce themselves in the sense that although the individual members of an organization might change the organization will still persist. Individual organizations change and evolve like living organisms, as can the type of organizations that come into being. For example, the guild system of the European Middle Ages emerged once an urban economy of specialized craftsmen arose, which in turn was the product of the new technologies that were developed and utilized in Europe during this time period. The guild system changed the nature of the economy and further stimulated the development of technology. Technology, economics and organization truly coevolved. We might also add that science may be thrown into this co-evolutionary mix as science thrived in a milieu in which technology, economics and organization were thriving and changing. It is no accident that the roots of the Scientific Revolution of Renaissance Europe can be found in the Middle Ages when the first universities were being formed and scientists the likes of Roger Bacon, Oerseme, and Buridan were laying down the foundations for modern science by challenging the scientific ideas of Aristotle.

Johnson and Earle [18] in the *Evolution of Human Societies* show that a similar pattern of evolution exists for the econosphere that embraces both economics and organization. Human societies based on symbols evolved from extended families, to clans headed by a big man, to tribes headed by a chief, to the state headed by various forms of government adapting to pressures from increasing populations. Each new form of governance or social organization incorporated elements from the form it descended from. Family is still the basic unit of society. Descent, modification and selection once again.

6. Are the Members of CLOSET Individual Organisms or Are They Species

We have argued that the members of CLOSET can be construed as living organisms in the sense that they propagate their organization and that they evolve much like living biological organisms. We have also indicated that the distinction one makes for living biotic organisms between individual organisms that are conspecifics and the species they belong to can also be made for language and culture construed as organisms. One is not able to make this distinction for science, technology, economics and organization construed as organisms because these cultural forms do not admit to idiosyncratic differences among those individuals that are involved in these activities, because they are strictly group activities.

Once one learns a language or adopts a culture one can pretty much use that language in written form by either reading or writing in that language without interacting with others. By the same token one can live by one's cultural norms, even when one is living in a society with another altogether different set of cultural practices. Englishmen during Britain's colonial era were able to adhere to their English cultural norms even when no other Englishman was in their neighborhood. In the hottest climates like India, Saudi Arabia or Africa they dressed and dined like Englishmen.

By their very nature, the cultural practices of science, technology, economics or organization require group participation and agreement and hence the distinction between individual science, technology, economics or organization organisms and species of conspecifics of these activities is meaningless. So when we talk of the teleodynamics of these cultural forms we are talking about the collective forms of these activities as behaving like a teleodynamic system. The same is true of language and culture because it is the collective language and the collective culture, *i.e.*, the language species and cultural species, which act in their own self-interest.

We therefore propose that the teleodynamic parallel of the elements of CLOSET with biotic living systems operates at the level of species and not at the level of individual organisms. But we also claim that, in addition to an individual organism acting teleodynamically in its own self-interest, species of biological living systems are also teleodynamic systems, in the sense that they act in a way that promotes the well being of the species as a whole as evidenced by kin selection, herd instincts, and social insects. Species act in a way to propagate themselves, *i.e.*, their species. I would argue that evolution is a way that a species makes corrections to insure its survival as a species as the environment in which it operates changes.

7. Are Culture, Language, Organization, Science, Economics and Technology Teleodynamic Phenomena? A Probe

The probe that I would like to examine is whether or not Deacon's notion of teleodynamics applies to culture, language, organization, science, economics and technology (CLOSET). If CLOSET behave as organisms, as I have suggested, then perhaps some form of teleodynamics might pertain to their organization and their persistence. I must confess that the motivation for this probe and the reason I embarked on this project to explore the question: "Are culture, language, organization, science, economics and technology teleodynamic phenomena?" came from the following passage from Deacon's ([1], p.275) book, *Incomplete Nature*.

> Teleodynamics can be understood as characterizing the distinguishing dynamics of life. However, rather than being an abstract description of the properties that living processes exhibit, teleodynamics is a specific dynamical form that can be described in quasi-mechanical terms. Although it is the distinguishing characteristic of living processes, it is not necessarily limited to the biological. Teleodynamic processes can be identified with respect to the specific end-directed attractor dynamics they develop toward.
>
> —Terrence W. Deacon [1]

This passage prompted the following thoughts: Do culture, language, organization, science, economics and technology (CLOSET) represent teleodynamic processes? Is there not an autonomy of CLOSET as they maintain themselves, as they self-organize, as they have agency? They are obligate

symbionts and hence their energy is provided by their hosts, but they assist their hosts to acquire energy and do work.

With regard to autonomy, the CLOSET do not have energy autonomy in the sense that they depend on humans for their source of energy, but they are autonomous from the standpoint of their development, in that a single individual cannot destroy them as they are self-contained. An individual can contribute to their evolution and enrichment by creating a neologism that catches on, or a new cultural pattern like the Beau Brummel suit jacket, or a technological invention or innovation like all of Steve Jobs' Apple products, or a new scientific paradigm like Einstein's theory of relativity, or a new economic model, or a new form of organization for CLOSET respectively.

It seems to me that culture, language, organization, science, economics and technology each have end-directed attractor dynamics they develop toward. This is why I think CLOSET represent teleodynamic processes. I believe that they are in fact autonomous agents that maintain themselves, self-organize, and have agency.

The following description of Deacon ([1], p.267) of the processes of living organisms seems to apply with almost equal validity to CLOSET.

> We find processes [for both living organisms and CLOSET] that (a) consistently partition thermodynamic processes so that many components processes follow trajectories that run radically counter to global thermodynamic probabilities; (b) are highly heterogeneous in structure and dynamics; (c) produce processes/behaviors that are so convoluted, divergent, and idiosyncratic as to defy compact algorithmic description; (d) generate and maintain aggregate systemic properties that are quite distinct from any properties of the components, and (e) reflect the effects of deep historical contingencies that may no longer be existent in their present context (with my addition of the words in the square bracket to indicate that CLOSET behave like living organisms).
>
> —Terrence W. Deacon [1]

Culture, language, organization, science, economics and technology (a) do not "run radically counter to global thermodynamic probabilities", but they are the tools that enhance their human host's ability to do so. There is no question that, like living organisms, (b) CLOSET "are heterogeneous in structure and dynamics" and that (c) they "defy a compact algorithmic description". It is also the case that CLOSET, like living organisms, certainly (d) have "systemic properties that are quite distinct from any properties of the [ir] components." Finally, CLOSET, like living organisms, are emergent phenomena and (e) "reflect the effects of deep historical contingencies that may no longer be existent in their present context".

Not only do CLOSET parallel the processes of living organisms they also undergo a parallel form of Darwinian evolution of descent, modification and selection. Deacon describes the evolution of living organisms in the following way, "the process of evolution, rather than merely maintaining and reproducing dynamical form, exhibits a spontaneous tendency for its dynamics to diversify and complexify these forms, both intrinsically and in their relationship to their contexts" ([1], p. 275). This description fits both living organisms and CLOSET.

Deacon argues that "The incessant need to replace and reconstruct organism components depends on synthetic form-generating processes, not merely resistance to breakdown" ([1], p.276). The individual

members of CLOSET also in a certain sense replace and reconstruct their components through form-generating processes as well.

For example:

- new **C**ultural practices arise through technological change, diffusion, and acculturation;
- new words are added to a **L**anguage through grammaticalization, portmanteau or neologisms;
- new **O**rganizational models arise to match changing conditions;
- new **S**cientific paradigms developed in what Kuhn terms revolutionary science;
- new **E**conomic models and **T**echnological breakthroughs through invention, innovation and diffusion respectively.

Like living organisms, the individual members of CLOSET are also self-correcting and self-maintaining. The claim that the individual members of CLOSET are teleodynamic systems suggests that these six species are self-creating, self-maintaining and self-reproducing respectively.

Language reproduces itself and came into being by self-organizing the signals used by individuals into a system of communication that can be easily learned and hence reproduced by imitation. This mechanism also insures the self-maintenance of the system as the use of expressions that do not maintain the integrity of the system will not be imitated and hence discarded.

Culture follows a similar pattern. The cultural practices that are easy to learn and ensure the survival of the society in the environment in which they operate self-organize and self-create the culture. Practices that ran counter to norms of society and which were inconsistent with the demands of the environment quickly die out, and hence culture self-maintains itself.

Technologies and tools that aid the survival of a society self-organize and survive, but those that do not aid survival of their hosts do not themselves survive.

Science by its very nature is a self-maintaining activity as theories inconsistent with the observation of nature will be eventually detected and discarded.

Economic and Organizational practices that promote the well being of a society self-maintain and self-repair themselves.

Culture, **L**anguage, **O**rganizations, **S**cience, **E**conomics and **T**echnology are activities that behave like living organisms that self-created themselves and behave like living organisms that self-regulate, self-reproduce themselves, self-correct and self-maintain themselves with the one exception that as obligate symbionts they depend on their human hosts for energy.

In conclusion the analogy between living organisms and the individual members of CLOSET consists of the following points:

- all propagate their organization;
- all evolve through descent, modification and selection;
- all are emergent phenomena;
- all arise from self-organization and catalytic closure; and
- all have a form of instructional information or constraints.

Conflicts of Interest

The author declares no conflict of interest.

References

1. Deacon, T.W. *Incomplete Nature: How Mind Emerged from Matter*; W. W. Norton & Company: New York, NY, USA, 2012.
2. Kauffman, S. *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*; Oxford University Press: Oxford, UK, 1995.
3. Logan, R.K. Review and Précis of Deacon's *Incomplete Nature: How Mind Emerged from Matter. Information* **2012**, *3*, 290–306.
4. Darwin, C. *The Origin of the Species by Means of Natural Selection*; John Murray: London, UK, 1859.
5. Christiansen, M. Infinite languages finite minds: Connectionism, learning and linguistic structure. Ph.D. Thesis, University of Edinburgh, Edinburgh, UK, 1994.
6. Deacon, T.W. *The Symbolic Species: The Co-evolution of the Brain and Language*; W. W. Norton & Company: New York, NY, USA, 1997.
7. Logan, R.K. *The Extended Mind: The Origin of Language and Culture*; University of Toronto Press: Toronto, Canada, 2007.
8. Chomsky, N.A. *Syntactic Structures*; Mouton & Co.: The Hague, The Netherlands, 1957.
9. Cronk, L. *That Complex Whole: Culture and the Evolution of Human Behavior*; Westview Press: Boulder, CO, USA, 1999.
10. Brown, D.E. *Human Universals*; MacGraw-Hill: New York, NY, USA, 1991.
11. Goodenough, W. *Culture, Language and Society*; Benjamin-Cummings Pub Co.: Menlo Park, CA, USA, 1981.
12. Basalla, G. *The Evolution of Technology*; Cambridge University Press: Cambridge, UK, 1988.
13. Cziko, G. *Without Miracles: Universal Selection Theory and the Second Darwinian Revolution*; MIT Press: Cambridge, MA, USA, 1995.
14. Mokyr, J. *The Lever of Riches: Technological Creativity and Economic Progress*; Oxford University Press: New York, NY, USA, 1990.
15. Vincenti, W. *In What Engineers Know and How They Know It*; Johns Hopkins University Press: Baltimore, MA, USA, 1990.
16. Logan, R.K. *The Sixth Language: Learning a Living in the Internet Age*, *2*nd ed.; Blackburn Press: Caldwell, NJ, USA, 2004.
17. Kuhn, T. *The Structure of Scientific Revolutions*; University of Chicago Press: Chicago, IL, USA, 1972.
18. Johnson, A.W.; Earle, T.K. *The Evolution of Human Societies: From Foraging Group to Agrarian State*; Stanford University Press: Stanford, CA, USA, 1987.