

## CHAPTER 6

# HISTORY AS AN INCREASINGLY COMPLEX SYSTEM

*CARLOS EDUARDO MALDONADO*

### INTRODUCTION

The study of complex systems stands at the cross-border of various sciences, disciplines, methodologies and even logics. It has given birth, indeed, to border sciences and precisely, border problems. Complex systems, however, have mostly been studied and understood as part of the physical, mathematical, biological and computer sciences. Even though little attention has been paid to social sciences as complex systems in precisely the terms of the sciences of complexity, the number of books and articles on human social systems as complex systems has been raising in the last few years<sup>1</sup>. Nonetheless, there is almost no work concerning the relationship between complexity and history. Perhaps the most conspicuous text in this direction is I. Wallerstein's (1987), a short and cautious work. Even though we can encounter several articles and a few chapters in books dealing with history and chaos, there is no consensus so far as to the relation between history and chaos and, additionally and most important, there is no real and deep understanding of the relationship between chaos and complexity and, henceforth, between complexity and history. As for the rest, the links and matches between history and complexity are timid or avoid facing history as science vis-à-vis the question of complexity. At most, the writings available so far deal with history as a tool, for instance in treatments such as: "the history of complexity", "complexity and economic history," and the like.

---

<sup>1</sup> As an example, the first book on sociology and complexity was published in 2006; in fields such as anthropology and even archeology a recent strand of papers and discussions have started and are growing and being enriched. In politics the contributions from complex sciences is already considered steady. In economics various works can be cited after Arthur Brian's pioneer work; perhaps the most conspicuous work linking complexity and economics are the books by Paul Ormerod; among philosophers a couple of books by Mario Bunge and Nicholas Rescher should be mentioned. Yet, in most of the social and human sciences there still seems to be a reluctant if not a skeptical attitude towards approaches dealing with self-organization, dynamic equilibrium, chaos, fractals, catastrophes, non-predictability, and so forth. However, these are just a few indications of the work being done. My aim here is not to write a critical bibliography on complexity and the human and social sciences; that is still to be done in the near future.

Moreover, in some of the top centers around the world devoted to the study of complexity almost, no attention has been given to history as a complex problem in the terms used to speak about complex systems in various other domains<sup>2</sup>. Perhaps the reason is that complexity sciences deal more with phase space (= imaginary spaces) and, philosophically speaking, much more with the possible rather than with past. Here I shall argue precisely that history can and should be considered as a complex dynamic system.

A good part of the reason for this sort of blindness regarding history and complexity has certainly to do with the normal understanding already set in the late 1980s, according to which complexity is a quantitative measure of nonlinear systems. If so, the problem for the social sciences is found in their (in)capacity to quantitatively measure their own systems, and behaviors. Several critiques run along this line, and, I believe very reasonably. However, I further believe that complexity is not to be reduced to just a quantitative measure or unpredictable and unstable phenomena and behaviors. Such an understanding of complexity provides a weak service to the task of grasping the kind of phenomena characterized as *complex and not just as complicated, hard, tough, or difficult*.

Thus very little, if any, attention has been put to the relations between history and complexity. With this text I shall argue that history can, indeed, be taken as a complex system, and I shall mention four arguments, all having an “if...so” structure; that is, they are conditional arguments. They are the following: i) History as science does not reduce itself to just human phenomena and scale. The human scale can indeed be taken as the scale one (1) and, hence, as the encountering point of both greater and lower scales. If so, then history can “dialogue”, so to speak, with complex sciences; ii) History can and should be viewed as an open system or field. More particularly, the past which is the proper domain of history is an open system. If so, then history is to be assumed by and as (a part of) the complexity sciences; iii) As is well known, history does not deal with human time as such, but only with historical time. However, historical time can and should be viewed in terms of time density. Time density, I argue, is nonlinear; iv) History is a shifting point between nature and culture. If true, then historiography, and more particularly philosophy of historiography enriches and complements the very philosophy of the natural, social and human sciences.

To be clear, my contention, when studying history as a complex system is against determinism, namely, the theory that the history of the world could only unfold as it did. As I shall have the opportunity to show,

---

<sup>2</sup> I particularly refer to the work being carried out at the Sante Fe Institute in New Mexico ([www.sfi.edu](http://www.sfi.edu)) and the Necsi (New England Complex Systems Institute) in Massachusetts ([www.necsi.org](http://www.necsi.org)), the Technical Institute in Vienna or the Free University in Brussels. Even if we take a look at what is being done at the Max Planck Institute, the same can be said.

assessing history as a complex system means that we can and should take history as an open system. My own position here will be from an epistemological point of view but also from the standpoint of philosophy of history. I shall argue that history can be taken as a complex system, namely a system of *increasing* complexity.

### **THE PROBLEM CONCERNING THE DEFINITION OF COMPLEXITY**

In a specialized bibliography, we can find several articles dealing with a dynamic comprehension of history, including history and chaos. However, there is no clear understanding as to the relationship between chaos and complexity and most of the articles dealing with chaos and history miss the point. Perhaps the first and up until now the most complete study relating both history and complexity is I. Wallerstein, (1987). It is indeed an insightful paper, and yet short and cautious. Wallerstein deepens his comprehension of history in the frame of complexity in a collection of papers published in 2004 under the common denominator of *The Uncertainties of Knowledge*. But what he writes remains valuable as an indication of a path to transit through, rather than a sort of systematic development. It should be noted, however, that Wallerstein's own insights depend, to some extent on I. Prigogine's work. Be that as it may, Wallerstein remains the best source for a further development concerning the relationship between history and complexity.

McCloskey's article from (1991) bridges engineering, particularly the use of differential equations, to history and narration by showing that a chaos-like language and approach can be complementary. While engineers specialize in metaphors, historians focus on stories. His frame, though, is chaos and not complexity. G. Reisch's article from (1995) comes closer to chaos while criticizing a kind of inferiority complex some historians and social scientists may have vis-à-vis empirical sciences. Of a quite different take, R.K. Sawyer (2004) sheds some new light about emergence, a different approach to causality which is and remains the historian's most valuable task about past events and phenomena. M. Shermer, writing in 1995, produced a harsh attack against scientism and the need to relate chaos and history. In spite of his strong and inclusive critique, it is a valuable and clear analysis of problems about history and chaos.

In my view, after Wallerstein's works just mentioned, the most important work has been carried out by W. H. McNeill. McNeill (1998 and 2001) shows both openness and long range vision concerning history and historiography. The most salient feature in McNeill's two papers is, doubtless, his call to bring together history and evolutionary theory, as well as the importance of framing both history and the historians' own work within the ongoing scientific worldviews that are being developed and discussed by the scientific community. While he does not deal with

complexity directly, what he says remains completely valid within the frame of complexity sciences, whether or not he is aware of it.

Nonetheless, perhaps the best study regarding the use and interpretation of chaos and/in history is Lindenfeld's article (1999) in which he takes as a guideline Turner's *Hitler's Thirty Days to Power*". Valuable as it is, complexity sciences remains out of the scope of his concern. However, his work may be taken as an inspiration to move forward along the path that leads from history and historiography to complexity.

Three articles can be mentioned as a tentative and careful *rapprochement* between history and chaos, namely, Reddy's paper (2001) on the logic of action in which he highlights the importance of indeterminacy, a most valuable complex notion. Stewart's article (2001) does not consider directly history or historiography and, at the same time, is rather critical of the common usage of complex theory language, methodology and tools. Concerning the relationship between history and complexity, this paper remains vague. Further on, Tucker's article (2001) is full of insights for a study on complexity and history, even though it appears she is not directly concerned about chaos or complexity as such. And yet, what she says about the philosophy of historiography is, I believe, to be taken into account for further developments in the context of complex systems studies.

J. L. Gaddis's (2002) wants to be set in the same wave length, so to speak, as Collingwood's and Carr's major books on history and the philosophy of history. Gaddis devotes one chapter (pp. 71-89) to chaos and complexity. As it is, Gaddis acknowledges McNeill's clear understanding and insights as to the need to open history (very much as Wallerstein himself talks about opening the social sciences in his Gulbenkian Commission Report (2004)). The opening of history and, *en passant*, of historiography to the physical and mathematical sciences will certainly enrich and broaden mankind's own comprehension of time, the world, and of the very scientific endeavor, as it happens. However, Gaddis offers no clarity on the distinction or relationship between chaos and complexity, giving thus the impression of two common and non-distinct concepts or fields.

As for the rest, I may say that among the community of experts in complex systems, there has been little concern for the comprehension of history as a complex system. At most, there are works on history from an analytical point of view, gathering data, constructing and re-constructing periods, and the like. No attention has been set to what could be called as a reflective or even a speculative use of history. From this point of view, the use of history by researchers on complex systems has been an analytical rather than a reflective or theoretical one. With this text, I wish to go into what can be named as a complex comprehension of history in terms of a dynamic complex system. I shall argue that history can be viewed in terms of a complex dynamical system when taking complexity as a nonlinear system. Such a comprehension, however, brings to the fore a serious debate

against causality, regularity and continuity as being the common and dominant patterns of history. I shall argue in favor of an evolutionary approach to history.

When studying complex systems, one of the difficulties is that there is no one definition or comprehension of complexity. Instead, various comprehensions and approaches have been reached. However, the most basic understanding of what a complex system is comes out of the identification of some of the features of complexity. Complex systems stand at the edge of chaos, are sensitive to initial conditions and respond to a nearby strange attractor in the sense pointed out by chaos theory. They exhibit emergence and self-organization, with a high degree of connectedness and synergies, and, most important, the arrow of time plays a crucial role. Thus, we can safely say that complex systems are those systems marked by the arrow of time, namely irreversibility. In one word, complex systems are basically characterized by an *increasing* though unpredictable process of complexification. Such a complexification means that the more complex a system is the more degrees of freedom it has, as these have been defined in mathematical or physical terms, e.g. the number of independent pieces of information on which a parameter estimation is based. In other words, it is the measure of how much precision an estimate of variability has. *The more degrees of freedom a system has, the more complex it is.*

Even though there has been no agreement on the definition of a complex system, the most generalized comprehensions are the following: Gell-Mann defines a complex system by its capacity to adapt and, hence, he calls them “complex adaptive systems” (CAS). S. Kauffman claims complex systems to be self-organized systems, and thus, self-organization is believed to be the most salient feature of complexity. For Bar-Yam, a complex system can be best understood in a meso scale, i.e. neither big enough nor too small, but rather having enough elements so that what becomes relevant is not so much the elements that compound a system, but their interactions. Prigogine prefers not to talk about complex systems, but rather about complex behaviors, and they are characterized by a mixture, so to speak, of contingency and necessity. For Prigogine, complex behavior is characterized by a dynamic equilibrium, and he calls such a system far-from-equilibrium systems, i.e. complex behaviors.

Here I shall adopt a different perspective, more in accordance with history and historical processes and events. Thus, I shall prefer to take a complex system as a nonlinear system, a comprehension which somehow runs tacit in the works of Kauffman, Bar-Yam, Gell-Mann and Prigogine, to mention but some remarkable authors, but this issue is not explicitly considered by them.

Whereas an equation is said to be linear because it has one (and only one) solution, a problem is defined as nonlinear since it has more than one solution; for instance when a problem exhibits squares, bifurcations, and non-steady patterns. History and historiography are much more

concerned with critical events and encounters in the study of crisis arousing motives for study and interpretation, analyses and narrative, explanation and evaluations. Crises depict nonlinearity precisely due to a strong short-term and long-term connectedness, to the interaction of both constant and inconstant agents, and by the very recognition of some events as having definite beginnings whilst others have vague beginnings. Likewise, for example, some have clear endings whereas others have indefinite endings.

To be sure, nonlinearity entails unpredictability and low control of situations, at least during certain times. Nonlinear situations and circumstances may have the appearance that agents seem to be at odds and passive in front of several forces and other subjects, but in reality it simply means that the available cognitive tools are not sufficient for agents to understand and explain what is going on at that time. Hence, nonlinearity calls for creativity, imagination and new insights concerning the very capability of knowledge, i.e. science and life. Several examples, both contemporary and historical could be mentioned here as illustrations. As it is often said, that happens when history faces so-called “bottle-neck” situations. Complex systems and complex behaviors exhibit erratic motion.

After these clarifications, I now turn to the arguments supporting why history can be claimed to be a complex system.

### **THE HUMAN SCALE OF HISTORICITY AND MULTISCALE ANALYSES**

Determinism is the philosophy according to which there is always a privileged standpoint over others and the world exhibits a necessary and, by definition, unique center out of which any other perspective is secondary and derivative. If true, then the world is meant to have a singular scale that determines and even undermines and makes impossible other perspectives, scopes and scales.

Complexity sciences, in contrast, have highlighted the very fact that the world both implies and leads to a multiscale approach, when appropriately understood. Put in simple terms, world history exhibits various levels, layers, nuances and perspectives which are to be taken even though the whole picture is not always coherent and ambiguous. Ambiguity is a central feature of human events that cannot be overthrown; such recognition is possible when studying history under the light of relevant and para-consistent logics. Ambiguity is a necessary and active feature in human history. It is not ambivalence which is negligent and passive.

History, indeed, does not exhibit any exact solution and certainly not a definitive solution. Over against postmodernist approaches that claim a kind of relativism and eclecticism, the complex approach to history is much closer to Heraclitean philosophy, rather than to the Eleatic school (Prigogine, 1980). History is, indeed, the realm of the unstable, dynamic and flowing experiences, whether viewed in short-term or in long-term scopes. Narrative as a valuable tool of both historians and philosophers of

history faces us continuously with open-ended explanations and provisory conclusions, as it were.

One way historians deal with multiscale analysis is by considering individual, social, and natural levels, the local and the foreign, the short-term and the long-term, the singular and universal, for example (this last in exactly the sense of the *Annales* school) always in their interdependence and reciprocal feedback. If so, where does the originality of multiscale analyses lie? Throughout the passage and combination of various scales a phenomenon that is being studied exhibits a wider, deeper and more enriched dimension, so much so that no scale is privileged.

The following can serve as both an illustration and an explanation of what I am referring to here. There is no one story in history, i.e. no one voice. On the contrary, history consists of a variety of voices, a polyphony, literally speaking or else also a polymorphy. Thus, for example, whereas it has been sufficiently stressed, history has been mostly the voice of the conquerors and the winners, there should be, though, also space for oral history—as, for example the not-yet-written-history-, for the voice of the excluded, the oppressed, the ones that suffer at the same time that there is a voice of the those who flourish and win. The play *Rosenkrantz and Gilderstein Are Dead* by Tom Stoppard is a fantastic example of what I mean here; one more good example is, of course, Akira Kurosawa's movie *Rashomon*. In music the recent explorations led by Yo-Yo Ma can be mentioned as outstanding examples where he combines both Western music along with traditional, non-Western or indigenous music. A relevant example in historiography is M. de Certeau's *La possession de Loudun*. Often the arts seem to be far ahead of the sciences—in this case Philosophy and the Social Sciences.

The consequence, though, is crucial and unavoidable: there is no one truth in history, no one past, no one future either. Instead, history is to be viewed as a crossing-up of experiences, all which compound a certainly complex fresco of human experience.

Such a polyphony of history, however, should and cannot be taken in any syncretic, relativistic or eclectic sense as if, then, “anything goes” in history, though it brings to the fore the question about human ambiguity<sup>3</sup>. In this sense, I believe, history can be taken as wise complementary tool vis-à-vis politics—taken in any wide and broad sense- which most of time claims the prevalence of one voice. Perhaps the sort of wisdom history brings about is possible when we consider events in and as a *longue durée*.

From a philosophical point of view, I would like to highlight here the Socratic dialogues of Plato in which it is clearly set that truth is not a property of any of the participants, but the outcome of interchange and openness to the others' questions and arguments<sup>4</sup>. Thus, truth comes, as it

---

<sup>3</sup> See A. de Whaelen's book on Merleau-Ponty, *Philosophie de l' Ambigüité*.

<sup>4</sup> See Guthrie.

is, at the end of the dialogue, if at all; for most of the time the result is an astonishment, a rejoice, a paradox or a feeling of pursuing the (everlasting) quest. In the age of globalization, this insight can set the conditions for further research projects. The historian's intelligence and sensitivity consists exactly in pointing out with the tools he or she has such a dynamics. Truth, indeed, is a movement and, why not, a tempo, in a musical sense.

Perhaps one of the most meaningful tasks historians may have consists in uncovering truths that have been silenced in history, while carefully appraising and reappraising the ones that have been already set and constitute valuable hints in the evolution of human culture. This does not mean, however, that they should not care for voices alive that strive to survive and indeed manage to succeed. In other words, historians must be capable of reaching an holographic view of history, so to speak.

Let me put it straightforwardly, even though in mathematical terms for the sake of precision and brevity, precisely what I refer to above as "polyphony" and the like is eventually simply a matter of combinatory analysis and of combinatory. If true, then we must turn our sight briefly to combinatory analysis, namely the understanding of those processes, structures and dynamics compound by many elements in such a way that from their interactions further new structures and forms emerge. Perhaps the most conspicuous historical essay in this research line has been set by Hölscher (1997), even though in his article, he seems to know very little about complex system.

Nevertheless, the past should be considered from a multiplicity of points of view in order to establish the coherence of all different features of a certain period, whether, for instance, these are social, cultural, political, philosophical or religious. Hence, the complexity of history consists in multiscale analysis.

As it is easy to see, expanding the scale of observation of a subject implies an integral cognitive approach that can be called by some as holism (Rozov, 1997, p. 342), and by others as complementary—taking in view Bohr's principle of complementarity, for instance. However, it is important to stress that complex systems study does not pretend to be a coherent approach, as it is in Ramsey's or in Rescher's philosophy. In this sense, it has nothing to do with systems theory approach (von Bertalanffy, von Foester, Bateson and others).

On a quite different note, Rozov (1997, pp. 343-44) traces several distinctions that can be taken into account in a wider study concerning multiscale levels of work related to history, thus:

*Nominative scale*, by which things are distinguished and supplied with names.

*Scale of order*, according to which objects are distributed in accordance with the relative degree of expression of a chosen parameter that can be assigned a number, but only the order is significant.



*Scale of intervals*, where numbers assigned to objects specify not only their order, but also “the distance” between them in a chosen parameter.

*Scale of relations*, that shows how much more a parameter is expressed in one object than in another.

*The absolute scale* which makes it possible to measure a parameter independently in single objects and to employ the entire series of real numbers.

The behavior of a system is governed by several factors being the most salient ones, its initial conditions, and the rules of transformation that govern the system’s behavior. (Now, the debate about the truth of some counterfactuals or other is a debate about the initial conditions which are obtained. Perhaps for this reason, the use of modal claims in history is often obscured. The debate may appear to be only about actual facts, but at stake are important modal implications (Bulhof, 1999, p. 165).

A multiscale analysis is, indeed, though it should by no means be reduced to, the recognition of the importance of counterfactuals. As one author puts it, “A counterfactual claim is the result of a mere manipulation of the initial conditions of a system, or of the outside influences of the system. We simply plug in different values, apply the same rules of transformation, and get certain results” (Bulhof, 1999, p. 168). The matter of multiscale and modal thinking is but the question regarding determinism in history from a quite different perspective and valuing it as a question rather than as a statement.

## **HISTORY AS AN OPEN SYSTEM**

There are no closed or isolated systems. The belief that the world consists of closed or isolated systems is called a zero-games world in game theory. Such is a world in which when there is one player who wins, then the other player necessarily loses. A winner implies a loser, it is claimed in accordance to such a belief. Complexity sciences, instead, claim that all real systems are open—for they have an environment that both encompasses and disturbs the system. The traditional and common way of considering the environment is as a spatial dimension. In this section I shall argue that the environment is not just to be considered in its spatial dimension, but it also has a temporal dimension. History is a way of dealing with the temporal dimension of the environment, very much like paleontology, archeology, and paleobiology. In other words, the world can be viewed as a non-zero game according to which when someone wins somebody else wins, too, even with differences, and when someone loses others lose too, even with differences. That is what history is all about when understood as a complex nonlinear system, hence open.

The concept of environment is essentially indeterminate. Indeed, as part of my environment belongs not only to the airplane that is passing by

right now in the sky, the kids that are playing in the backyard with their shouting and laughing, for instance. This environment can go on depending on the influence, and disturbance or affection of spatial circumstances upon me. However, to my environment the Egyptians, the Summarians, the Mayans, for example, are also integrated to some extent. The very depth and width of history depends very much on my knowledge, my intelligence and my (historical) sensibility. History is a presence as large, deep and wide as both the spatial and temporal dimensions that can be seen, and intertwine with each other. Historical time affects me according to my historical sensibility, my intelligence and my knowledge<sup>5</sup>. If so, then a society, a culture or a nation's own intelligence and sensitivity to their temporal dimension of the environment depend very much on the very knowledge and care with which historians deal with the past.

Past is an open system, for it is always susceptible of being re-written, re-interpreted and re-signified, albeit not an open system as such or in itself. Past is an open dimension, indeed, depending on the actions and moves of the present, for it is the present which sees past as an open or a closed system. When it is seen as a closed system, history is reduced to one tradition at the cost of other traditions and experiences. It is also possible to find a fundamentalism towards the past and not only in past times. This, however, should not be understood as if the past was *just* susceptible of such re-interpretations, for historians can be viewed as the "carers", so to speak, of the past. Past is indeed only what historians define it to be and tell us the way it was. If so, then semiotics plays an important role in this sense.

If history can be said to be an open system it is because *we*, living human beings, make history complex. This assumption makes an important point, I believe. Complexity depends on the observer, who sees and introduces varieties, nuances, layers, scales into what is fixed or has been set to be fixed. From this perspective, complexity is a feature introduced by the observer into the historical time, and *then* history becomes complex, as it were, allowing us to see new structures and textures in the historical events. Thus, for example, we can retrospectively gain new insights into history and make it more complex by studying and discovering the everyday life of the Aztecs, or the Egyptians, or the Greeks, not to speak of the Middle Ages. From a different take, history can be seen retrospectively as a matter of genre, minority groups, and the like. The contributions by the *Annales*, from the *Past and Present* group or from the Bielefeld school are, in this sense, both illustrative and conspicuous, their disagreement and differences notwithstanding.

Historians, though, are that part of society that has the task, so to speak, of veiling and unveiling the past. In other words, society trusts to

---

<sup>5</sup> I could even argue that future is included in my temporal dimension of environment as, for example, when we consider sustainability—but that is a different concern from a historical perspective. For history is human experience writ past.

historians the care for the past, even though it knows that historians construct a dynamic unity, as it were. Kuhn's concept of "scientific community" with its pros and cons is also to be found here and understood.

The various temporal modes of history are—in English and in fact in most Western languages—past tense, perfect tense, past continuous tense, including the modes past conditional, past subjunctive tense, and so forth. Indo-European languages know basically three modes: indicative, conditional and subjunctive. So far, we have to learn to speak of past in these modes. Time and logic have worked meaningfully on these tenses, and moreover on the distinction between time, tense and modality<sup>6</sup>. History and historiography are then a matter of how to write history "forwards", and not just "backwards", and certainly in a nonlinear way and scale.

I wish to highlight the consequences of environment as being both spatial *and* temporal, i.e. geometrical *and* historical. History implies and demands, henceforth, a cross-disciplinary approach. In other words, we find here the call, so to speak, for thinking beyond history and geography. When Hegel claimed that there were peoples with more geography than history—thinking about America, of course, most theoreticians have easily also found that the opposite can be true. Beyond that dispute, my point is that history can be conceived ecologically, namely as the articulation of a space and time that goes beyond the usual classification and work splitting natural sciences from social and human sciences. History, I claim, when appropriately understood, can be on the same wave-length, so to speak, as ecology. There is one name for such an encounter, namely evolutionary theory. Therefore, history focuses on men and mankind but in the frame of the intertwining of natural and human systems, which is what precisely defines a system as complex.

I want to make my point here: history is an open system, which means not only that history is made out of various traditions, some alive, some definitely past, and some others in emergency rooms. History is an open system that becomes increasingly complex as the flow of present enriches, widens and deepens it in accordance with the very evolution of science and culture.

If true, then history is revealed as the field of indetermination or indeterminacy, as it were, in spite of mankind's quest for roots, answers, identity and the like in past or backwards. History and evidence—historiography are therefore called to the fore, and the subject that immediately arises concerns history theory and philosophy of history as well as their relationship. The importance of a philosophy of historiography lies in how to make of history not just a story and a matter of interpretation—often wild, wish-full and subject to manipulation by fear, power, publicity and propaganda. The fact that history is an open system

---

<sup>6</sup> Concerning modality, the crucial subject is the relationship between the actual world and the possible worlds. This point, however would take us too far afield for the present.

does certainly not undermine the importance of evidence and, hence, of historiography. Instead, the very claim of history as an open system means that the construction, study, and interpretation of the sources must not be regarded only as a matter of narrative and metaphor, but also of explanation and theory.

Thus, the old discussion about “Clio, muse or science?” can be re-framed as a complementary result of the dynamic balance between narrative and theory and, *à la limite*, logic; more particularly non-classical logics<sup>7</sup>. I think that we all must be concerned about the dilemma involving the two cultures (after Snow’s classic book) and the sincere effort of some to overcome that duality. There is, to be sure, no hierarchy of knowledge and discourse in spite of what traditional scholars have taught us. If history is open and hence a matter of both story-telling and explanation, then the question regarding the “two cultures” can be posed for history and historiography in terms of a complementary space between muse and science, but not as an exclusive either—or.

#### **TIME DENSITY IS NONLINEAR**

History, very much like life, is made up from different time structures and textures, different time rhythms and speeds. This is exactly what constitutes the complexity of history, namely the complexity—diversity of time and temporal orders. Such recognition, however, has not been sufficiently stressed or highlighted in the course of both history and philosophy of history. Instead, most of history has been presented as governed by a unique or a single time scale, reducing significantly the density of time, sometimes due to political, religious, and ideological interests. By reducing or eliminating the density of time, history has been conceived and worked out as a linear system where events have had one and only one voice, as it were. Often such a history and historiography is called “official” history leading to a canonical time interpretation and understanding.

The question of what an event means in history, I argue, can never be answered completely by telling a certain story about it, since there will

---

<sup>7</sup> By non-classical logics—also known as philosophical logics and even as alternative logics—we can understand those logics that either are complementary or alternative to classical formal logic, and hence deal with problems left aside, but the classical formal logics that derive from Aristotle on, such as time, contradiction, context, multi-deductive systems, modality, the existence of many values, and so forth. Examples of such non-classical logics are: para-consistent logic, relevant logic, time logic, quantum logic, fuzzy logic, many-valued logic, modal logic. To be sure, it would be important for both historians and philosophers of history to cope with such alternative logics. The reasons are numerous and meaningful. Yet, they remain out of the scope of this paper. These themes are planned for discussion in a future volume.

be stories to be told about it in the course of time. One major task of the philosophy of historiography consists exactly in positing the polyphony of history, so to speak.

A matrix can be outlined as an indicator of the variety sketched above:

<b>Historical Time Density</b>	Rhythm	Speed	Direction	Intensity
Positive reinforcement				
Negative Reinforcement				

This matrix can be filled by assigning either arithmetical or algebraic values (as one pleases) to reveal an interesting, wonderful problem of combinatory analysis<sup>8</sup>, and as an exercise for valuing the various processes and paces in historical time.

History, like society, is compounded of people, institutions and practices some of which work slowly, whereas others work more quickly, some in one direction and others with a different vector, some having certain expectations and hopes, whilst others resign and give up, and so forth. The complexity of society consists in the variety of time orders, time scales and time speeds.

Let us take an analogy from ecology and biology: in the same way as we cannot assess whether there are key species and redundant species, we cannot affirm whether some time speeds and time orders are more fundamental than others.<sup>9</sup> The best we can say is: “we do not know”—we do not know whether there are key species or not as, indeed, we learn from evolutionary biology or from ecology. In accordance, we do not know whether some time order is crucial or necessary at the cost of others. Therefore, a more prudent attitude can be outlined by stating that history is made of various threads, just as a rug is made of various textures.

---

<sup>8</sup> Positive reinforcement and negative reinforcement can also be stated as positive feedback and negative feedback (more used by experts in complex studies), or even for increasing returns and decreasing returns, as economists might express it. The meaning of this footnote is to set bridges with various other approaches.

<sup>9</sup> From an ethical point of view we should never forget that perhaps the most fundamental activities for mankind have been traditionally carried out by “inferiors”, such as cleaning and hygiene, feeding and cooking, transportation and vigilance (security). After all, complexity theory is very perspicacious against the Platonic-Aristotelian view of a hierarchy of knowledge, as well as society. Complexity thinking is nodal and non-centralized. See Y. Bar-Yam (1997) and K. Mainzer (1998).

The problem of history is the problem of change, i.e. evolution; more accurately the issue is about the change of history, and not just the change in history. How can history change? What is a historical change? This is where the three basic sides make up a jerky or fuzzy triangle: history, historiography, and philosophy of history (as well as philosophy of historiography). Most probably, historical change is to be found far more in the change of the way we observe the same object at two different points in time—for history cannot be changed *in re*, only *de dictum*. Throughout such a triangle, a liberation can occur. According to one author, “Liberation emerges out of being able to criticize the destructive myths of our ancestors without either ignoring the past, losing cultural depth and historical perspective on our lives, or just relativizing fraudulent narratives without really criticizing them” (Tucker, 2001, p. 56). An historical change, instead of being defined as the change of an “object” within a set of given parameters, has to be perceived as the change of parameters related to a given historical object (Hölscher, 1997). In other words, the change of history is carried out by our contemporaries, not by past human events.

As Marx has pointed out, men make history, but they do not always make it as they please. Moreover, most of the time, they cannot make it as they please. This becomes clearer the more we focus on change, i.e. historical change. For history, as opposed to politics, is made and read in the long run. (“Long run”, though, is a vague and indeterminate measure). This same idea can be stated differently, thus: “We are at one with our predecessors, immersed in a process we do not control and can only dimly understand—a process, nonetheless, that has made us and our agreed-upon systems of meaning the most disturbing, changeable, and quite extraordinarily power factor in upsetting the multiple levels of physical, chemical, and social equilibria within which we exist” (McNeill, 2001, p. 15).

Gould has insistently called our attention to the pace and the motives for change: “Do large effects arise as simple extensions of small changes produced by the ordinary deterministic causes that we can study every day, or do occasional catastrophes introduce strong elements of capriciousness and unpredictability to the pathways of planetary history?” (quoted in Shermer, 1995, p. 69). Whether we find or prefer small changes or catastrophes is precisely a matter of one of the components and the very matrix of time density. Historical time, therefore, is the outcome of a time density throughout which we can see events, processes, and phenomena in history that are useful as hints, landmarks or just tips of what can be overlapped from past to present.

If it is, indeed, hard to obtain a long-range view, the reason is based upon the pace and variations of the historical paths and motives we find or strive to encounter in history. Such is exactly the very complexity of

a universal history, for the more we dig into history, the more diverse and dense are the orders, scales, and rhythms of human experience<sup>10</sup>.

To be sure, history is not useful to predict events and processes, for its value is just as an indicator or a reference. But history does not necessarily tell us that things should be in such and such way. At most it can tell us how things might be possible—and that is already a matter of modal thinking. Modal thinking, though, leads us again to nonlinear time density—very much in the same tenure, for example, as counterfactual logic and time logic. The question then shifts to the relationship between history and the possible, and not just history and the past.

Thus, we go from history to politics and back to history in the sense that after acting, deciding, or organizing—or at least after considering what has been done, or what could have been done—we re-do, so to speak, history and change again. We bring, if you wish, its openness to the present. In other words, working on history becomes very much a matter of traveling in time backwards and then forwards to the future which is present. We travel in time towards the future when we decide—a decision is an action that is taken towards the future—but with the past in mind. Yet, this has not been sufficiently recognized and what mainly passes for history today is a variety of case studies from various parts of the world—Asia, Africa, East Europe, and Latin America, etc. We lack an integrative theory. History seems, in such a view, to be more a subject for government and international affairs schools<sup>11</sup>.

## **HISTORY AS A SHIFTING POINT BETWEEN NATURE AND CULTURE**

A shifting point in human knowledge is currently taking place. Such a turn goes hand in hand with the uncertainty, unpredictability and sort of indeterminacy of the present and the short-term future; let us say, the immediate foreseeable future. The long term consequences are being simulated, discussed, projected in as many ways, languages and modes as possible. We have discovered, for the first time in human history, that we have, indeed, put all our eggs in one and the same basket. Moreover, in

---

<sup>10</sup> On this cross-point there is much to discuss, namely the relationship of information and memory as regards history. I believe memory has been taken more as a question and even as a sort of dialectics between memory and forgetfulness (as in Nietzsche's *On the Use and Abuse of History for Life*). Indeed, we must see history more in terms of offering us information rather than memory. Moreover, history is the very story through which we gain information, but not from memory. However, this discussion is beyond the scope of this article.

<sup>11</sup> As a conspicuous example, see S. P. Huntington, "Political Conflict after the Cold War", in *History and the Idea of Progress*, ed. Arthur M. Melzer et al. (Ithaca, N. Y.: Cornell University Press, 1995), 137-154.

historical terms, we have been playing with the basket. In social and political terms, we are still currently playing with the basket.

In similar circumstances human beings, specially in the Western world, have traditionally turned their heads to culture and to history. The examples and cases are numerous and well known. I shall leave culture aside for the time being. As for history, it can be useful only as a hint, a tip, or an indicator, nothing more, nothing less.

The course of human history is, indeed, strongly influenced by the growth of human knowledge, and human knowledge is a living system, indeed (Wallerstein, 1987; Maturana and Varela, 1990). Human knowledge not only evolves, it also develops<sup>12</sup>. If so, then we ought to bring history into convergence with other sciences. I take this to be both an intellectual and a moral imperative in the future to come. History, historiography and philosophy of history, I would argue, can benefit from a cross-disciplinary approach<sup>13</sup>—which is indeed another way for understanding what complexity sciences are all about.

Yet, there is one important proviso here: History is but what historians think, do and write<sup>14</sup>. If true, then from this point of view the complexity of history would include the complexity of semiotics, hermeneutics and logic, not to mention archival research and the quest for “real” evidence, i.e. historiography. From all this, I believe, a clear consequence follows, namely a new concept of history arises: instead of history being a metaphysical unity of space and time (the destiny of mankind, the positivist’s world of facts), in which everything is linked to everything, it is instead the product of historical judgment carried out by those who design stories about their own past, present, and future, that is to say, historians.

We can speak of history as a system that changes continually and that knows equilibrium only in a few instances, for its very nature is change and non-permanence. When Ionesco—the father of the so-called “theater of the absurd”-, complained that the only teaching of history he values, is that we never learn from it, he was referring to the fact that human memory is short-lived. We never seem to catch up to time. I think Ionesco is right in that we separate memory from information. In this sense the matter of history is like evolution, just as S.J. Gould said at the end of his life.

---

<sup>12</sup> This remark is to be understood in the way we have recently learnt to speak in terms of “Evo-Devo,” which stands for: evolution and development. Evo-Devo can be said to be a new science emerging from the intersection between evolution (and genetics) and genomics.

<sup>13</sup> In this sense, see I. Wallerstein: *The Gulbenkian Commission and Report Open the Social Sciences*.

<sup>14</sup> So it is and so it has been sufficiently known since history started as a science, around 1929-beginning of the 1930s, all the way long up to the 1970s, according to P. Chaunu.



Throughout history, I claim, we do not gain memory; we rather gain information.

If so, we are to distinguish history from tradition. Tradition is that realm of social reality through which we preserve and even gain memory. That is why tradition rests on rites, repetition, time cycles. History, on the other side, does not rest on rites and the like, but it focuses on continuities as well as discontinuities, time and space symmetries—for instance, geopolitics— as well as on the breaking of time and space symmetries. More particularly, history is about the arrow of time, and not just about time cycles (in spite of Gibbon's *The History of the Decline and Fall of the Roman Empire*, 1776, 1781, 1788)<sup>15</sup> for instance.

The most important consequence of the assessment according to which history teaches us about information rather than about memory is that the very historical process is about the gaining of degrees of freedom. Freedom is studied by the sciences of complexity, but certainly to philosophers this may sound like a new type of Hegelian comprehension of history. Nonetheless, history is an increasingly complex system, thanks to the fact that we have been slowly, and exactly in a nonlinear way, gaining information. Information becomes the process of gaining new degrees of freedom in that time marks an irreversible arrow.

By claiming that history is not so much about memory as it is about information, I intend to say that history is not exactly about remembering, remembrance, recording, keeping records, etc. Such an interpretation of history is laden with preconceptions and conflicts of interests. That view can easily be called a conservative one, for it is supported by those who want to reduce history to a determinate tradition. Instead, I am saying that history is about communication—the basic stone for communicating is information. Moreover, my claim is that because history is about information and not so much about memory, history is, therefore, about knowledge. And as it has recently been pointed out by the new biology, knowledge is a biological feature rather than just an intellectual structure (Maturana and Varela, 1990; Kauffman, 1995; Kauffman 2000).

In other words, history, I argue, is not a cumulative matter. It is on the contrary a question about creating possibilities and reading and telling possibilities, albeit past ones.

Indeed, whereas memory implies a sense of permanence and even presence—particularly sketched out in terms of the *mémoire involontaire*—information theory reckons the importance of both information as such and of noise. Moreover, information is considered not as the “other side” of noise, but as the very outcome of there being noise. Finally, the problem emerging here is about information and entropy and how noise and entropy

---

<sup>15</sup> Perhaps the most conspicuous example of history as consisting of stories about time cycles is E. Gibbon, *The Rise and Fall of the Roman Empire*, The Penguin Press, 1994. With reference to a philosophy of history in this same line, we should mention Collingwood's and E. H. Carr's classic works.

sum up, as it were, the very information of systems, processes and behaviors.

Most of the considerations of history and what might be called the unstable deal only with chaos theory. In these terms, thinking in chaos and history means considering an event's sensibility to its initial conditions and the further long-scale, unpredictable consequences of that event and that sensibility. But this is only half of the story, so to speak. For the other half consists in identifying a strange attractor that deviates the normal "current" development of the event. Hence, unpredictability and the identification of a strange attractor produce large unpredicted and long scale consequences, indeed. The next step must be accomplished, I believe, from chaos to complexity, in order not just to stress the existence of chaotic moments in history but also, and mainly, to understand history as a process of increasing complexity whereby information and noise, information and entropy interact and act upon each other as a positive loop. That is to say, as a process through which history can be seen as a living system and not just as a reservoir of values, events, names, and data.

Complexity theory, i.e. science, does not explain everything, for the very same reasons that the world *is* not complex. (A theory that explains everything explains nothing, a fact well known from epistemology). Complexity theory deals only with complex phenomena or complex behaviors that exhibit (or consist in) unpredictability, emergence, self-organization, strong interaction, and so forth. As for the rest, namely causality, reductionism, control and predictability, etc., normal science suffices.

In other words, complexity arises when acknowledging the intersection of contingency and large tendencies, wherein contingency is but the action of non-rational and non-conscious forces and events in the individuals and groups forging history. Contingency refers to the everlasting presence of surprise and the unforeseen.

History, indeed, is made by human beings, although human beings do not always act or behave as they think they do, most people act in most situations in accordance with various forces: anger, love, hate, revenge, desire, angst, etc. Emotions are the hidden force of history. The difficulty for historians is to account for these emotions in the midst of evidence and circumstances. Past actors did not always appreciate, see, or adequately evaluate and channel their reactions. (Such is rather the working field of psychology). In other words, history is a human feature, but human features are not always susceptible of sheer logic, strategy, control, and plans. Along with these, there is also a sense of opportunity, a contingency with salient actions and reactions. As is well known, historians are aroused by studying and explaining the kind of individuals that either respond to a certain personal feature, or profit from social circumstances. They give to history a direction not previously expected. Historians do not predict, they "postdict." Nonetheless, perhaps part of the historian's intelligence consists

in predicting the “ex-post factum.” That is to say, in predicting in the past what the past exposes to the future.

In times of global speed and anguish when the pace of life and events seems to run amok—due to the rhythm of technology, finances, and the like—history can provide a sort of wisdom. This wisdom comes from acknowledging that while history is an open and nonlinear system, everything is settled calmly and gently in the *longue durée*, after all. As mentioned, history is made and read in the long-run as opposed to politics. If so, then by digging into history we can gain more than knowledge, memory and information. We can, indeed, gain wisdom: letting what will be.

This, however, does not lead to a passive attitude. Quite the contrary, it leads to a work of reflection, of thought, gratitude, and openness<sup>16</sup> Let things be—that is, I claim, the call from history. If it is, indeed, true that for want of a horseshoe the horse was lost, and eventually the kingdom was lost, then we had better look for ultimate causes in history, which is not the same as looking for first causes, as the Aristotelian tradition claims. The quest for ultimate causes is, indeed, a subtle, quiet and thoughtful work, enquiring about nonlinear causes and effects. Diamond’s recent books on the collapse of cities and civilizations, as well as the reasons why some societies are more powerful than others (*Collapse: How Societies choose to Fail or Succeed*, 2005, and *Guns, Germs, Steel: The Fates of Human Societies*, 1999) are examples of the quest for ultimate causes. And yet, I think Heidegger also, for a time, at least, seemed sympathetic to this point of view.

Taking history as a complex systems, and hence as open and nonlinear, I should stress, calls additionally for a re-enchantment of the world, an expression first coined by I. Prigogine (1984). The re-enchantment of the world consists in the very polyphony of the past. For there is no one past, and no one gate to the past. There are, rather, various gates, passages and labyrinths, as well as avenues and country roads to the past. But also, there are various other ways of communication from past to the present. Perhaps one of the most astonishing ones—a favorite one of historians, writers and philosophers—is the *mémoire involontaire—presence*. As it were, there is present and also past. But somewhere lingering between the two is *presence*. Historians and philosophers know about that “presence” and treat it with care.

## CONCLUSION

To conclude, a few short remarks are in order. To be sure, history is written history. Yet, history is not just writ past. There is also oral history, as it is well known. But when the historian encounters oral history,

---

<sup>16</sup> I recognize a similarity to Heidegger on this point, related to *Was Heisst Denken?* Nonetheless, my own frame and aim are different from Heidegger’s.

he or she is open to anthropology to philosophy to archeology to art. Such is a good example of cross-disciplinary work on history, and an articulation of a kind of border/problems work.

Thanks to, and sometimes even in spite of, the various historical schools from *Annales* to Marxist historiography to the American social science historians to the *Past and Present* group, to the Bielefeld school, we have enriched, enlarged, and deepened history as never before. With each effort, we take away new scientific achievements and research<sup>17</sup>. History in fact has become more complex; an *increasingly* complex system, indeed. By the same tenure, quoting P. Anderson's famous paper from 1971 "More Is Different", history has gradually become different to us than what it was to our elders. History, as we can readily see, calls us again to be open, for history is a dynamic system—a living one, to be sure. No matter the discussions against evolutionary theory, history has evolved and thus calls our attention to information rather than to just memory.

With the previous arguments I claim the following: philosophers should deal with history, talking and working with historians—as to how they do research, how they write and come to decisions, etc. very much in the same sense as they should work with scientists of any range or specialty. Only, I argue, through this can a philosophy of history be productive and suggestive, and not just sheer speculation—as it has emerged over the centuries. One might think of Vico, Herder, Hegel, and others.

There are, to be sure, law-like events in history. There are large-large consequences, too. There are also events that were to be postdicted and even predicted in history. This is not, however, the history I am talking about here. My point here is that we can and must look for the importance of small events that had long-term effects—of contingencies that meant great shifts—of unpredictable situations that made the present difficult at that moment—of an unstable world that meant crisis and revolution.

History as a complex system is meaningful only when we understand the world in terms of crisis and revolution, namely, great changes and bottlenecks. In steady times complex analyses are not desirable and not even convenient. This, of course, implies that the regular scenario of history—birth, growth, and death- does not hold any longer. Instead, we now seem to exist with the astonishing knowledge that we have come to live in a non-zero sum world.

---

<sup>17</sup> To mention but a few references, In 1650, James Ussher, Archbishop of Armagh and Primate of All Ireland, established the age of the universe based on the Bible at nearly 6.000 years that result from summing up the years of the Exodus, plus the years of Mathusalem, and so forth. Moreover, he proved, based on the Bible the exact day of the creation: Sunday, 23 October, 4004 B.C. By the time of Kant and Laplace the universe was said to be a few million years old. Currently the age of the universe is estimated at 13 to 15 billion years.

Complexity—and chaos. Most of comprehensions have been so far related to chaos theory. There is a big difference, though, between chaos and complexity. To the question, What makes a system complex, there are various answers, ranging from chaos to catastrophe theory to fractals to non-equilibrium systems, and to non-classical logic. Hence, chaos (theory) is only one way of answering what makes a system complex. Here I have dealt with a different approach, namely nonlinearity, and I have argued that history can be taken as a complex system when viewed as an open nonlinear systems.

As opposed to the majority of the comprehensions of history in terms of a dynamic system linking just chaos theory, we can never assess that history *is* a chaotic system. At most we can safely say that history exhibits from time to time, and always in non-regular or periodic times, chaotic behavior. My concern here has not been whether history depicts chaos in various moments and places. Instead, I claim that history as a whole can and should be viewed as a complex system, namely a system of *increasing* complexity. The arguments for such a claim are: history is an open system, history is a nonlinear system, history implies a complex density of time, and history is a shifting point from social sciences to natural sciences and back to social sciences but in a positive, self-correcting feedback mode.

There remains, though, a serious difficulty, namely the fact that history deals with past events, whereas complexity deals with possible events. The question then becomes about the relationship between past over against possibility. Such a question, however, remains out of the scope of the present article.

## BIBLIOGRAPHY

Bar-Yam, Y., (1997). *Dynamics of Complex Systems*. Addison-Wesley.

Beekman, C. S., and Baden, W. W., (2005). *Non-Linear Models for Archeology and Anthropology: Continuing the Revolution*, Ashgate Publishing, 2005.

Bulhof, J., (1999). "What if? Modality and History", in: *History and Theory* 38 (May), 145-168.

Bunge, M., (2003). *Emergence and Convergence: Qualitative Novelty and the Unity of Knowledge*. Toronto: University of Toronto Press.

Carr, D., (1967). *What Is History?* New York: Vintage.

Collingwood, R. G. 1994 [1936]. *The Idea of History*. Oxford: Oxford University Press.

Cowan, G., Pines, D., Meltzer, D. (eds.) (1994). *Complexity. Metaphors, Models and Reality*, Perseus Books, Cambridge, M.A.

Gaddis, J. L., (2002). *The Landscape of History. How historians map the past*. New York: Oxford University Press.

- Gould, S. J., (1987). *Time's Arrow. Time's Cycle. Myth and Metaphor in the Discovery of Geological Time*. Harvard University Press.
- Fracchia, J., and Lewontin, R. C., (2005). "The Price of Metaphor", in: *History and Theory* 44 (February), 14-29.
- Hölscher, L., (1997). "The New Annalistic: A Sketch of a Theory of History", in: *History and Theory* 36 (October), 317-335.
- Kauffman, S., (1995). *At Home in the Universe. The Search for the Laws of Self-Organization and Complexity*. Oxford University Press.
- \_\_\_\_\_, (2000). *Investigations*. Oxford University Press.
- Lindenfeld, D. F., (1999). "Causality, Chaos Theory, and the End of the Weimar Republic: A Commentary on Henry Turner's *Hitler's Thirty Days to Power*", in: *History and Theory*, 38 (October), 281-299.
- McCloskey, D. N., (1991). "History, Differential Equations, and the Problem of Narration", in: *History and Theory* 30 (February), 21-36.
- McNeill, W. H., (2001). "Passing Strange: The Convergence of Evolutionary Science with Scientific History", in: *History and Theory* 40 (February), 1-15.
- \_\_\_\_\_, (1998). "History and the Scientific Worldview", In: *History and Theory* 37 (February), 1-13.
- Mainzer, K., (1998). *Thinking in Complexity*. Springer Verlag.
- Maturana, H., and Varela, F., (1992). *The Tree of Knowledge. The Biological Roots of Human Understanding*. Shambala.
- Nicholis, G. and Prigogine, I. 1977. *Self-Organization in Nonequilibrium Systems*. New York: Wiley-Interscience.
- Prigogine, I., (1980). *From Being to Becoming. Time and Complexity in the Physical Sciences*. San Francisco: W. H. Freeman and Co.
- \_\_\_\_\_, (1999). *Las leyes del caos*: Barcelona: Crítica (original en francés, 1993).
- Prigogine, I., and Stengers, I., 1984. *Order out of Chaos. Man's New Dialogue with Nature*. Foreword by A. Tofler, Bantam Books, New York.
- Reddy, W. M., (2001). "The Logic of Action: Indeterminacy, Emotion, and Historical Narrative", in: *History and Theory* 40 (December), 10-33.
- Reisch, G., (1995). "Scientism without Tears: A Reply to Roth and Ryckman", in: *History and Theory* 34 (February), 45-58.
- Rescher, N., (1998). *Complexity. A Philosophical Overview*. New Brunswick (U.S.A.) and London (U.K.): Transaction Publishers.
- Rozov, N. I., (1997). "An Apologia for Theoretical History. In memory of Sir Karl Raimund Popper", in: *History and Theory* 36 (October), 336-345.
- Runciman, W. G., (2005). "Culture Does Evolve", in: *History and Theory* 44 (February), 1-13.
- Runia, E., (2006). "Spots of Time", in: *History and Theory* 45 (October), 305-316.

Sawyer, R. K., (2004). "The Mechanisms of Emergence", in: *Philosophy of the Social Sciences*, Vol. 34, No. 2, June, 260-282.

Shermer, M., (1995). "Exorcising Laplace's Demon: Chaos and Antichaos, History and Metahistory", in: *History and Theory* 34 (February), 59-83.

Stewart, P., (2001). "Complexity Theories, Social Theory, and the Question of Social Complexity", in: *Philosophy of the Social Sciences*, Vol. 31, No. 3, 323-360.

Tucker, A., (2001). "The Future of the Philosophy of Historiography", in: *History and Theory* 40, February, 37-56.

Waldrop, M. 1992. *Complexity. The Emerging Science at the Edge of Chaos*, Simon & Schuster, New York.

Wallerstein, I., (2004). *The Uncertainties of Knowledge*. Temple University.

Wallerstein, I., (1987). "Historical systems as complex systems", in: *European Journal of Operational Research*, 30: 203-207.